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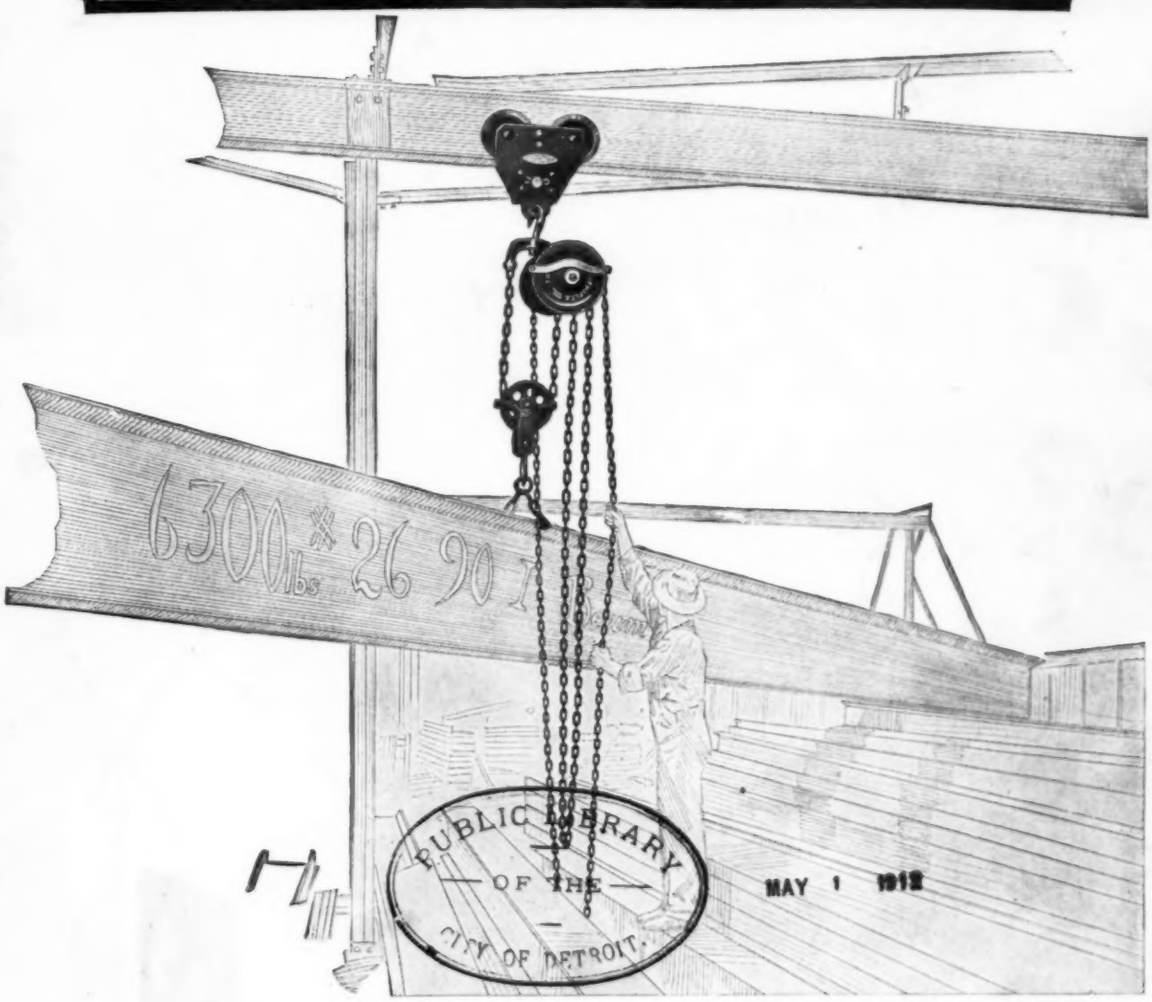
THE TRIPLEX BLOCK



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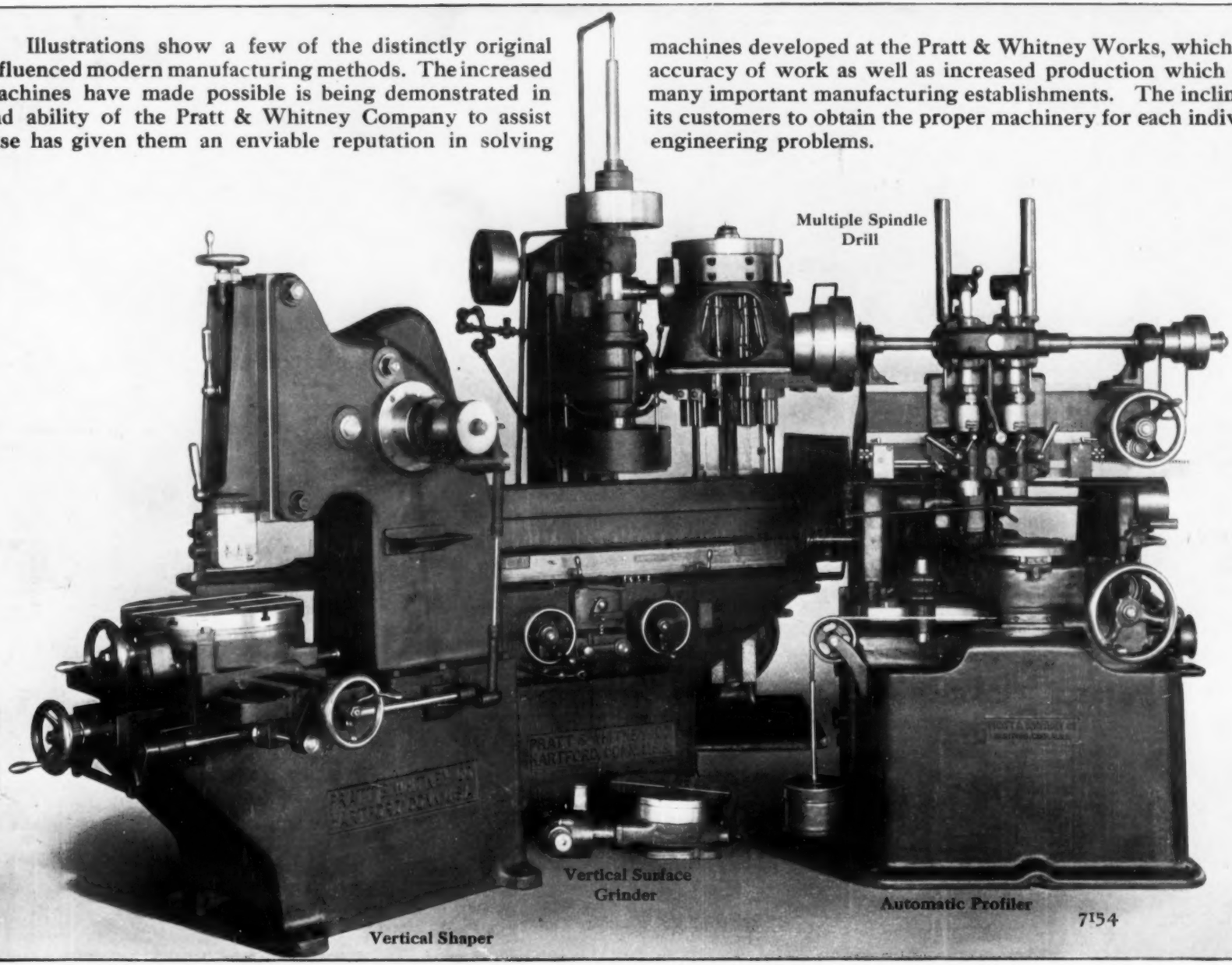


The Manufacture of Steel Balls

By E. A. Suverkrop

Forging, grinding, lapping and gaging methods used in a factory whose capacity is a million balls per week.

Owing to the fact that each Smith-Premier typewriter requires in its construction about 1000 steel balls, a complete ball plant, with a capacity of about a million balls of all sizes per week, is part of the equipment of the factory in Syracuse, N. Y., and here balls from 1/16 to 7/16 in. in diameter are turned out.

Forging the Blanks

The steel used is a high-carbon stock which has been found most suitable for balls entering into the construction of the typewriter. The bars for the 7/16-in. balls come in 15-ft. lengths. Figs. 1 and 2 show, respectively, the rear and front of a ball forging machine, five of which do the necessary forging.

Bars of stock are laid in the racks *B*, Fig. 1, only one of which shows at the back of the machine. One of the bars is led forward, as shown, between the feeding fingers *C*. These feeding fingers are mounted on the shaft *J*, which is positively driven from the main shaft of the machine, as the feeding must time with the other functions of the mechanism.

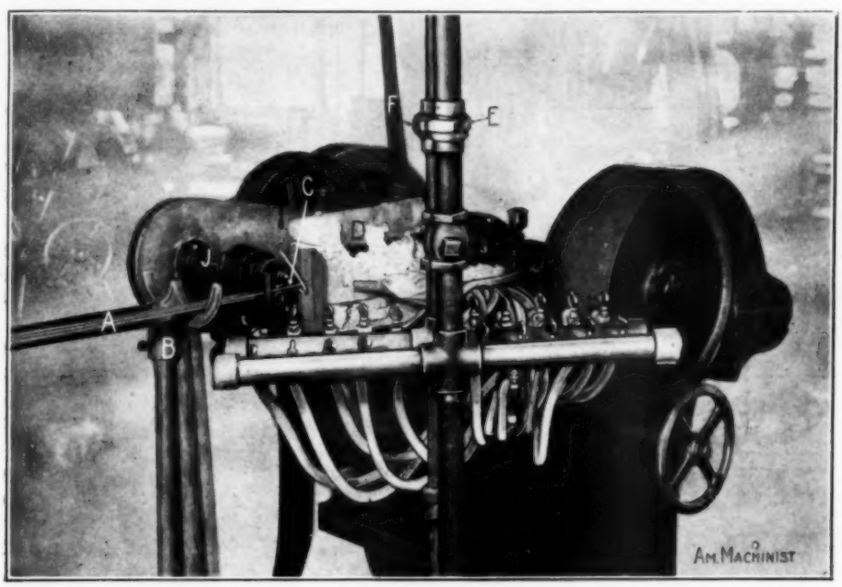


Fig. 1. Rear of Forging Machine

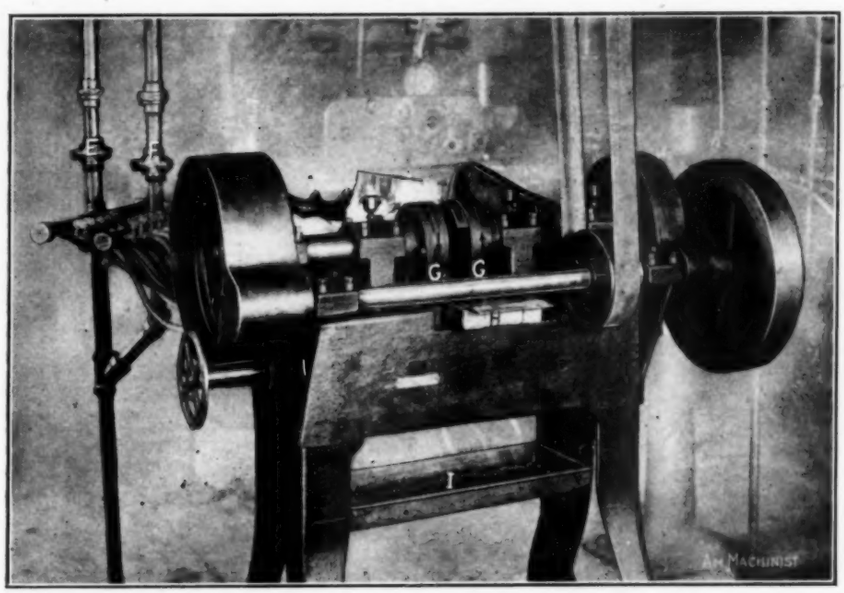


Fig. 2. Front of Forging Machine

The rod being operated on passes through the furnace *D*. This is made of firebrick luted with fireclay. The firebox on the machine shown, which is the large one, has two compartments with a support between for the bar. This arrangement limits the scrap to about three inches at the end of the bar as shown at *B*, Fig. 5.

The forging machines are provided with an electric alarm which notifies the attendant when the bar is nearly used up. This enables one boy to tend four forging machines and also do the sorting referred to later. Heat is furnished for the large-size stock (7/16 in.) by ten bunsen burners supplied with gas and air respectively through the pipes *E* and *F*.

Referring to Fig. 2, *GG* are the two forging rolls which are shown in detail in Fig. 3. The arrows indicate the direction of their rotation. Mounted on the disk *D* of each forging roll is a segment *A* of high-speed steel to resist the heat, which has a semicircular groove in it. This groove is concentric with the disk *D* and its center is parallel with the face of the disk. The edges of the semicircular groove are finished off sharp as shown at *E*, and the end where hot-roll forging begins is tapered as shown at *C*. The object of this is that the forming of the ball can proceed gradually from *F* to *G*.

It must, of course, be remembered that there are two tapered rolls traveling in opposite directions and that their ends, as at *F*, Fig. 3, take hold of the hot rod simultaneously. When the positions *G* in the rolls are opposite each other the ball is severed from the rod and from *G* to *H* the ball simply rolls between the two complete semicircular grooves in the oppositely revolving segments *A*. The scrap falls into one receptacle shown at *H*, Fig. 2, and the forged balls into the one shown at *I*.

At *A*, Fig. 5, is shown the end of the bar with the ball and scrap still attached. This was removed from the machine before the points *G* of the segments reached the work. At *B* is shown the end of the bar after the ball and scrap have been severed. The 7/16-in. balls shown at *C*, are the rough forgings just as they come from the forging machine. These balls are forged about 0.015 in. and the 1/2-in. about 0.008 in. over size. Balls 7/16 in. in diameter are forged at the rate of 28; 1/4-in. 35, and 1/2 in. 128 per minute.

The next operation is sorting. This is done by hand with the aid of a micro-

scope, a pair of tweezers and a board. Imperfect balls and scrap which have accidentally become mixed are separated from the perfect balls by placing some of the product at one end of the board and raising that end. The perfect balls will roll freely off the other end while the imperfect ones and the scrap will remain on the board. The bench, board and tools for sorting are shown in Fig. 4.

The forgings from new forging rolls are practically perfect spheres and do not go to the grinders, but are lapped soft to hardening size, which is a few thousandths over finished size.

The Grinding Machine

The rough-forged balls when not perfect enough to go directly to the lapper are ground soft in the machine shown in Figs. 6 and 7. The balls are placed in an angular groove which is open at the bottom. The upper spindle carrying the head *A* is then lowered. This head not only holds the balls down to a seat in the

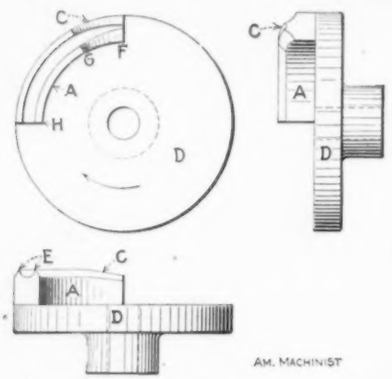


Fig. 3. The Forging Roll

V-groove, but rolls them as well when the power is turned on.

The pulley *C*, Fig. 6, drives a spindle which carries at its upper end an abrasive ring. This spindle is eccentric with the V-groove so that at one point the *inner* edge of the abrasive ring is *outside* the V-groove and at a diametrically opposite point, the *outer* edge of the abrasive ring is *inside* the V-groove. In this way the whole face of the abrasive ring is used for grinding. It has the further advantage that the ring dresses itself and while turning it tends to roll the balls in a direction at an angle to the V-grooves. The rings are made of 80-grain emery, are 3-in. face, 11½ in. diameter, and last about three months.

The balls in position in the V-groove *E* are shown in Fig. 7. Some were purposely left out at the right so as to show the open bottom of the groove. The head *A* is shown raised in this illustration.

The details of the grinder are roughly shown in Fig. 8. The holding-down ring *A* rests on the balls *D* in the V-groove *B*. The abrasive ring is shown at *C*. A thing to be remembered is that as the balls are ground smaller they seat deeper or protrude further through the bottom of the V-groove; for this reason as the grinding proceeds the abrasive ring first feeds upward and then gradually recedes, because the balls by reason of their decreased size feed toward the abrasive, which if advanced, or even held stationary would be too rank in cut. An indicator which is actuated by the ring *A* shows the size of the balls at all stages of the grinding.

The balls as they come from the grinder are shown at *D*, in Fig. 5. The abrasive cuts run in every direction and the balls have a decidedly rough, file-like surface.

The $\frac{5}{16}$-in. grinders, of which there are two, will accommodate about 150 balls each at a charge, and about 14,000 balls can be ground on them in nine hours. The $\frac{5}{32}$-in. grinders, of which there are four, will take about 285 balls at each charging and about seven thousand $\frac{5}{32}$-in. balls can be ground per hour. As high as 8500 per hour have been ground, but this is an exceptional output. After grinding the balls are hardened, when they appear as shown at *E*, Fig. 5.

Lapping

The next operation is lapping. This is done with cast-iron rotary laps and No. 1 flour carborundum with a little oil as lubricant. Fig. 9 shows the laps. The upper part *A* is a head having a vertical flange projecting downward on the lower edge of which is a half-round groove the size of the ball. The lower part *B* has a corresponding groove for the reception of the balls. The upper head *A* rotates but the bottom *B* is stationary, and can be slid out onto the table *C* for inspection from time to time, or for charging, which is being done with the aid of a V-shaped scoop by the operator at the left.

Twenty of these lappers are in use and a man can attend to five machines. The

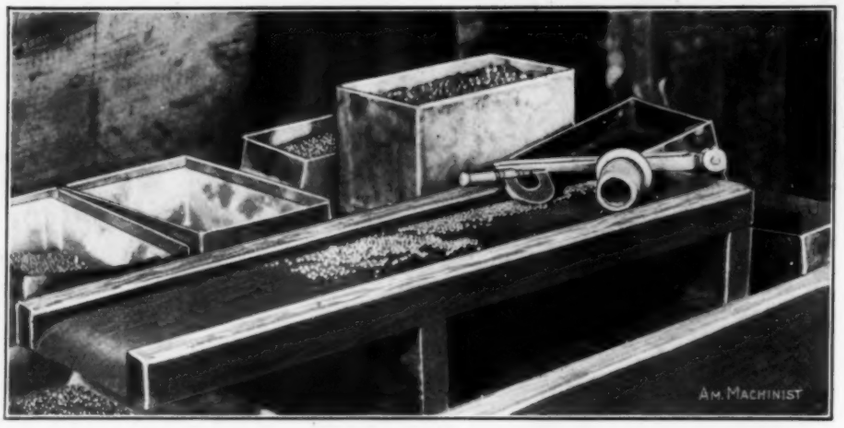


Fig. 4. Sorting Table and Tools

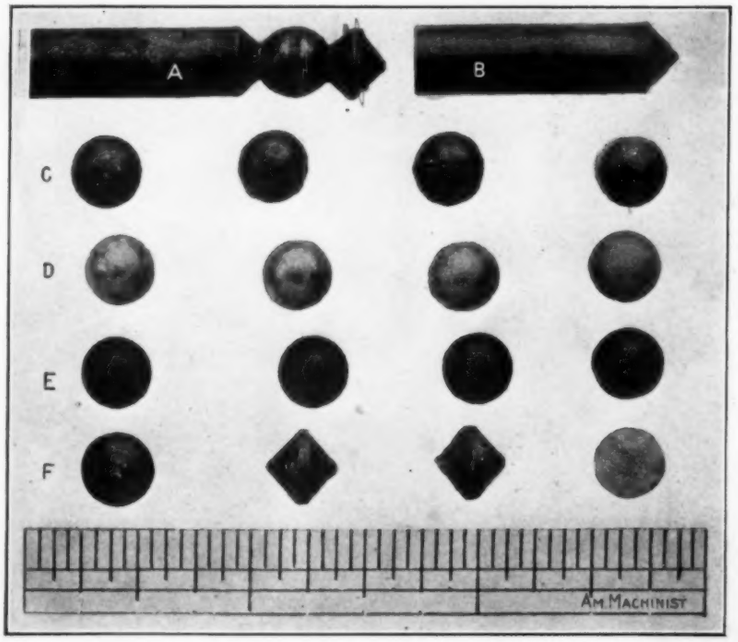


Fig. 5. Various Stages of the Ball

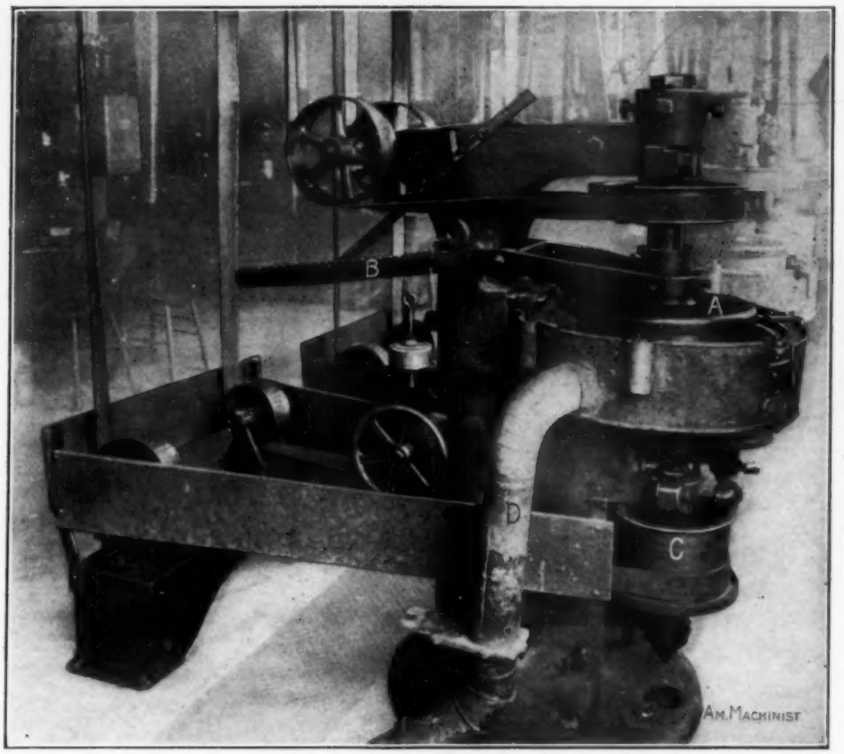


FIG. 6. VERTICAL-SPINDLE GRINDER WITH REVOLVING TABLE

lapping time averages about 15 minutes for a set of five hundred $\frac{1}{2}$-in. balls. Each lapper is provided with a dial as shown at *D*, Fig. 9. This has two hands, one of which is set to the time when the set of balls was started and the other to the time at which it will be advisable for the operator to stop the machine and size the balls with his micrometer. The size tolerance on $\frac{1}{2}$-in. balls is 0.0007 in. The laps stand up for about 20 hours before returning is necessary.

A section of the lap in shown at Fig. 10. The half-round grooves *C* and *D* are turned in the lathe, the tool being left at the same setting for each. The lathe has a faceplate which is provided with a spigot fitting a hole in both the upper and lower members *A* and *B* of the lap.

CUTTING ACCURATE GROOVES IN THE LAPS

As it is difficult to produce an accurate half-round groove, the groove is only partly finished in the lathe. The finishing is accomplished in a very simple manner. As previously stated, the balls, after hardening, are rough, very similar to spherical files.

The lap is mounted and charged with these file-like balls, but before any abrasive is put in, the machine is given a few turns. The hard, rough balls file the grooves both top and bottom to a perfect fit. The abrasive is then put in and the lapping proceeds.

After lapping, the balls are again inspected for roundness. The inspection is the most peculiar part of the whole manufacture, the tools used are an eyeglass, a pair of tweezers, and a micrometer. The skillful inspector can readily pick out a ball which is out of round as little as 0.0001 in. One which is 0.0002 in. out of round can be picked out from a batch of round balls by anyone, as it appears to be oval and about twice as long as it is broad. This exaggeration of the error is caused by the reflection of the light rays from the lapped surface and is somewhat similar in effect to the method of using the reflection of a wire for testing the straightness of gun barrels.

When the out-of-round balls are removed, the perfect balls are tumbled in

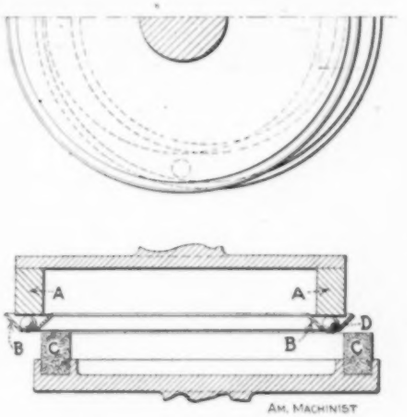


FIG. 8. THE GRINDER IN SECTION

FIG. 7. THE BALLS IN THE V-GROOVE IN THE GRINDER

leather dust in wooden barrels. This puts the final polish on the balls, after which they are again inspected with an eyeglass for defective balls. Those which pass this inspection then go to the sizing machines.

FINAL GAGING

The final operation consists of sizing. The machine used for this purpose is very simple and with slight variations is used in all ball factories.

It consists of a hopper at the top into which the balls are placed. This hopper is provided with an automatic feed so that but one ball at a time can pass out at the bottom. In front of the bottom opening, two accurate steel straight-edges are secured. The edges of these straight-edges are closer together at the upper end near the opening in the hopper than they are at the lower end by the amount of the tolerance, in this case 0.0007 in.

FIG. 9. THE LAPS

Underneath the slot between the two inclined straight-edges a series of boxes is arranged. As the balls emerge from the lower openings in the hopper they roll down the slot till they reach the point where the slot is wide enough for them to drop through into the receptacle below this point. Owing to the fact that some balls would attain greater velocity than others of the same size when rolling freely down the incline and consequently would not fall into the correct receptacle, a retarding device is used. In some factories this is a screw with a very thin thread,

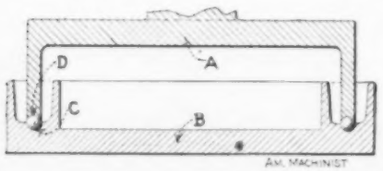


FIG. 10. THE LAPPER IN SECTION

the space between the threads accommodating the ball. The screw as it turns allows the ball to roll down the inclined slot, but it has no chance to attain any great speed.

The gaging machine used by the Smith-Premier Typewriter Co. has a hopper *J*, Fig. 11, into which the balls are put. From here they pass down through a tube as needed into a pocket *B*. The pocket fills only to the mouth of the tube, then no more will come down till some of them have dropped out. The disk *C* has a vertical flange on one side of it. This flange has holes drilled in it to correspond to the pitch of the chain.

Under the disk is a band of steel which fits close to the disk for half its circumference on the bottom. As the disk rotates in the direction of the arrow the balls drop into the holes by gravity and drop out when they pass above the end of the band. They then roll into the chain *F* which has a pin projecting upward on each link. These pins are bent back at an angle of 45 deg. from the faces of the steel straight-edges *EE*. The object of this is that the bent pins support most of the weight of the balls and thus prevent wear of the straight-edges while the balls are being carried to the points where they will drop through.

Under the straight-edges *EE* are pockets with the outlets *A* leading alternately to one side and the other of the machine. Beneath these openings are the boxes *H* to receive the balls. These boxes when filled are emptied into bottles and labeled according to size. As previously stated of the $\frac{1}{32}$-in. balls, seven sizes, rising by 0.0001 in., come within the tolerance.

Acknowledgment is made to J. Byers, who is in charge of the ball plant, for valuable coöperation, and many points of information that helped in the preparation of this article.

There should be in every well conducted plant a definite watchfulness of the question of wastes of material, for it is here that the human difficulty arises. Operatives, through carelessness, accident, or of natural necessity, will spoil material, and in many cases even dispose of the waste surreptitiously.—*Engineering Magazine.*

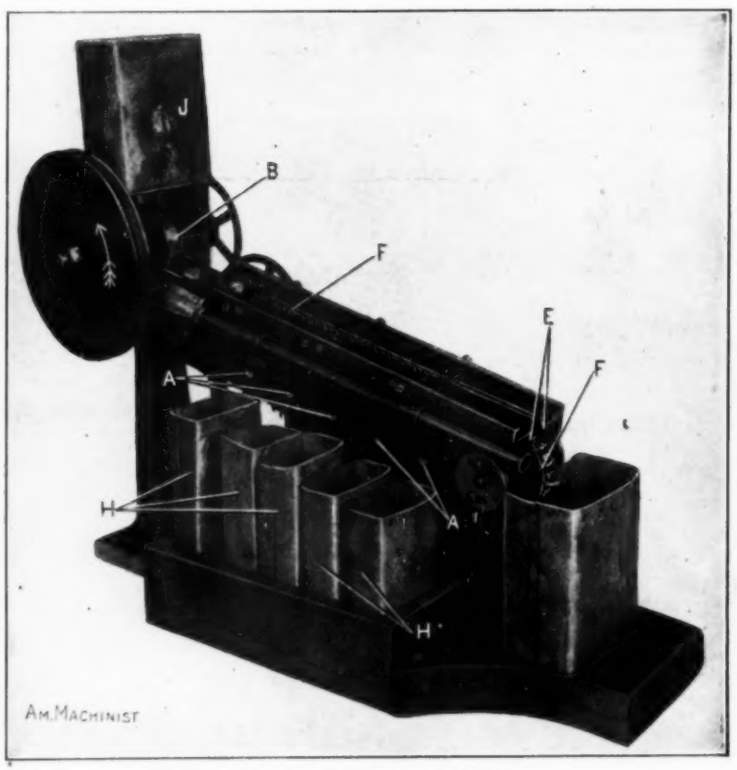


FIG. 11. THE BALL-SIZING MACHINE

A Southern Circular Saw Factory

By Ethan Viall

Details of the machines and methods used in making both solid and inserted-tooth circular saws.

Special grinding, polishing and milling machines.

Inserted-tooth parts and the way they are made.

No busier or more hustling shop can be found in the entire South than that of the Southern Saw and Machinery Works Atlanta, Ga.

The shop not only makes solid and inserted-tooth circular saws of its own brand, in all the standard sizes, but it also manufactures teeth for every well known make of inserted-tooth circular saw on the market. This last item is very important to the Southern sawmill men, as they do not have to send far for repair teeth no matter of what type.

Besides its manufacturing, the company does a large repair business in replacing teeth broken out of circular saws, its method, which will be explained later, enabling it to quickly replace broken teeth so that a saw so repaired is made as good as new at a fraction of what a new saw would cost.

Making Circular Saws

The methods used in making circular saws do not differ materially for the solid or inserted-tooth type, except that there is an extra operation or so for the latter.

The steel disks used for the saws come from the steel mills in sizes slightly in excess of the finished saw and the first shop operation consists of marking and center-punching the center hole, and then drilling and reaming as shown in Fig. 1. The center hole, of course, does not have to be absolutely true with the circumference as the subsequent operations remedy any slight inaccuracy that may exist.

The use of a drilling machine suspended from the ceiling makes it possible to drill and ream any size saw disk without interfering with a column, as would be the case with anything else except the largest radials.

Fig. 1. Method of Drilling and Reaming the Saw Blanks

Punching the Teeth

After the center hole has been finished the teeth are cut in a punch press, as shown in Fig. 2. A special punch and die are used for each style of tooth, but the same indexing plate is used for all saws having the same number of teeth.

Another view of the press just shown is given in Fig. 3, with the saw removed. This shows an indexing plate at *A;* the dog at *B;* the spring for holding the dog in contact at *C;* and the arbor or center on which the saw is placed at *D*.

It will be seen that the carriage *E* may be moved along the bed to accommodate various saw diameters, and that there is a cross slide *F* which may be moved by means of the handwheel *G* in order, if necessary, to change the angle of the tooth cut by a certain punch.

An old punch press used for cutting teeth in some of the large heavy saws, is shown in Fig. 4. This is somewhat similar in action to the one just described except that an automatic device is used for revolving the saw disk while cutting the teeth.

The press itself has quite an interesting history. It is a double-end press of very heavy construction. At present one end is used as a shear in addition to the saw-tooth work. It was brought over from England 50 or 60 years ago and in unloading it from the ship, something gave way and the press went into the harbor, where it lay for several weeks before it was finally fished out. After several movings it found its way to Columbus, Ohio. It was taken from there by one of the firm to its present location, where it has been for 27 years. There is no name on the press to identify the maker, but he certainly built a machine to last.

Fig. 2. Punching Out the Saw Teeth

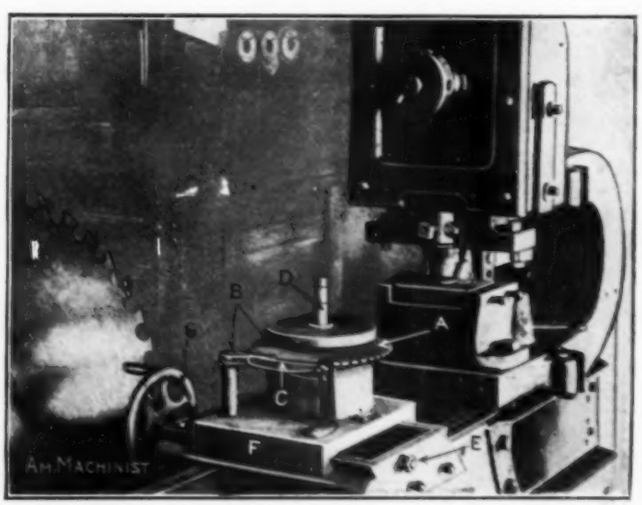


Fig. 3. Indexing Device and Saw Holder

HARDENING

In hardening large saws they are heated evenly and carefully in special furnaces and then dipped in a large oil bath, set directly in front of the heating furnace, so that the saws may be slipped into it with the minimum exposure to the air.

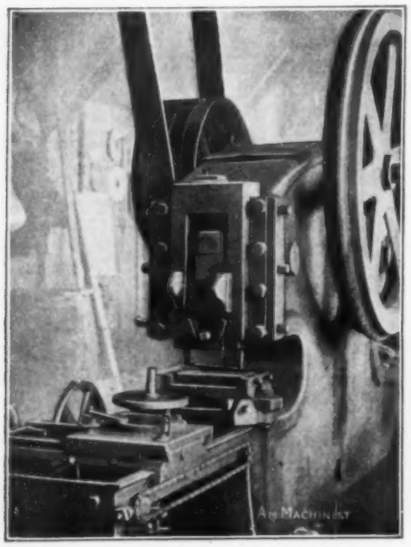


FIG. 4. OLD PRESS USED FOR HEAVY WORK

As the hardening and tempering methods are more or less dependent on the result of long experience in saw making and could not be successfully followed in individual cases, they will not be gone into further in this article.

GRINDING

After coming from the tempering room the saws are hammered straight and then ground to gage in the machine shown in Fig. 5. The saw to be ground is placed on a D-shaped mandrel between the brackets at *A*, and fed in between the grindstones *B* and *C*. Geared rollers at *D* act as a brake on the saw, compelling it to revolve slower than the grindstones, though in the same direction.

The carriage carrying the saw may be fed in by hand by turning the handwheel *E*, but while grinding, power feed is used. This power feed is run from a friction disk *F* through a pulley *G* on the shaft *H*. The shaft *H* is connected to the feed-screw *I* by the bevel gears at *J*. By moving the handle *K* the pulley *G* may be moved back and forth on the disk and the carriage run in or out at various speeds or, with pulley at neutral in the center of the disk, it will remain stationary.

The capstan *L* is used to move the grindstones in or out, and in grinding, the saws may be made thinner near the center by gradually bringing the grindstones closer together as they grind toward the center of the saw, plenty of water, of course, being used whenever grinding.

The method of applying the feed for the grindstones is clearly illustrated in the next two halftones. Each grindstone has a box on each side which works on a slide. These boxes may be moved back and forth by means of large screws, so connected by bevel gears, as to work simultaneously, as shown in Fig. 6, the bevel-gear shafts being worked by means of the capstan previously mentioned, through the worms and worm gears shown at *A* and *B*, Fig. 7.

One of the smaller grinders with the saw removed, is shown in Fig. 8, and illustrates more clearly the working of the rollers which govern the rotation of the saw during the grinding. These rollers *A* are geared to each other at *B* and *C*, and to the shaft *D*, at *E*. The shaft *D* is carried in the bearing brackets *F* and *G* bolted to the carriage bed, and is run by the pulley *H*, belted to a countershaft overhead. In use the pulley does not slide along the shaft, but the gear *E* does, as the carriage is fed back and forth, a spline being cut in the shaft for the purpose.

POLISHING

The final polishing is done after the saws have been ground and straightened, on the machine shown in Fig. 9, the small saws being placed as shown at *A* and the large ones on the opposite end. The polishing is done by pressing the block *B* against the saw and sliding it along as the saw revolves. The end of the block that is held against the saw is covered with leather and charged with an abrasive.

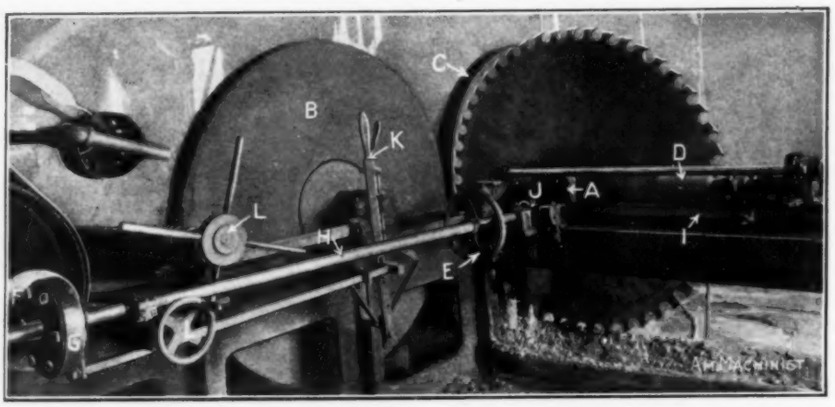


FIG. 5. MACHINE FOR GRINDING SIDES OF LARGE CIRCULAR SAWS

STRAIGHTENING

As has already been stated, the saws are straightened both before and after grinding, the hammering being done on flat-topped anvils as shown in Fig. 10, a process with which many are familiar in a general way but few can practice successfully, the expert hammering of sheet metal to make it perfectly flat requiring long practice.

A number of the special hammers,

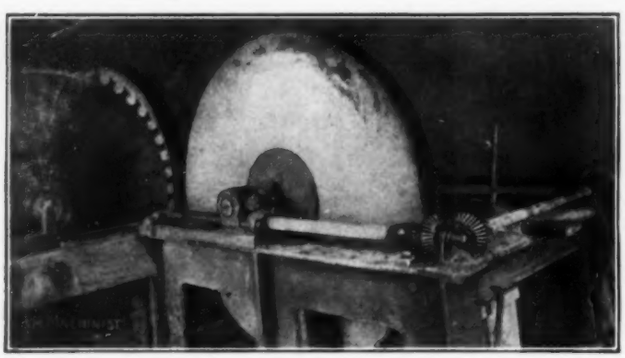


FIG. 6. GRINDSTONE-CARRIAGE MECHANISM

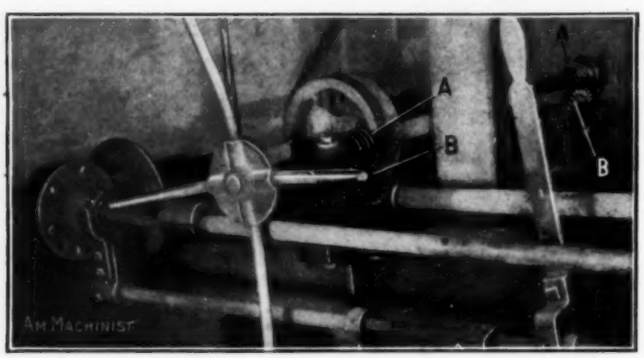


FIG. 7. CARRIAGE AND SAW-OPERATING APPARATUS

straight-edges and stamps used in saw work are shown in Fig. 11, and in Fig. 12 a workman is shown applying a straight-edge to a large saw. This method, however, is more for inspection purposes, as the hammerer makes use of his smaller straight-edges while the saw lies on the anvil.

Swaging Ends of Solid Teeth

The ends of some of the solid-tooth saws are upset or swaged, so as to be wider than the thickness of the saw. This is done by using a hammer and swages like *A*, Fig. 13. After the teeth have been swaged the saw is mounted as shown and revolved, the ends of the teeth all being filed to the same length, using a file mounted as at *B*, the bracket *C* being made to slide along the slotted piece *D* in order to accommodate different diameters of saws. Two of the sets used on these saws are shown at *E* and *F*.

Replacing Broken Teeth

The method of fitting in new teeth to replace broken ones is clearly shown in Fig. 14, a piece of saw steel being mortised in, drilled, riveted and brazed, and then carefully filed to the same shape as the other teeth. A number of teeth may be replaced in this way and it is almost impossible to detect them and they invariably prove stronger than the original ones.

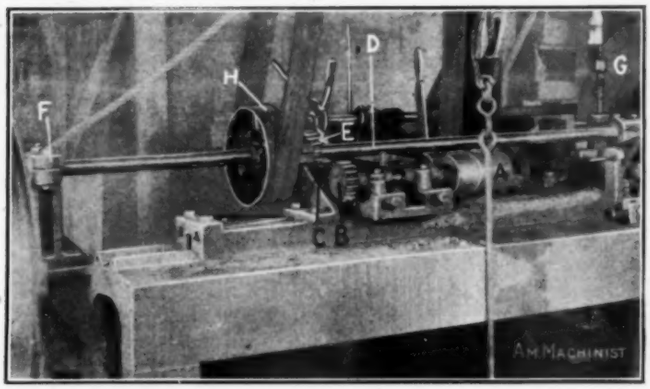


Fig. 8. Saw Carriage and Brake Rollers

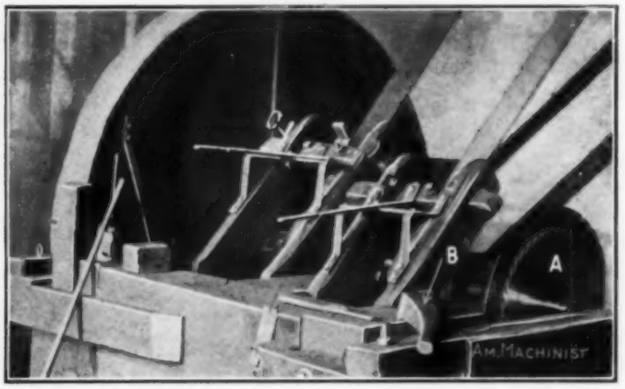


Fig. 9. Polishing Machine and Polishing Block

Fig. 10. Hammering the Saws

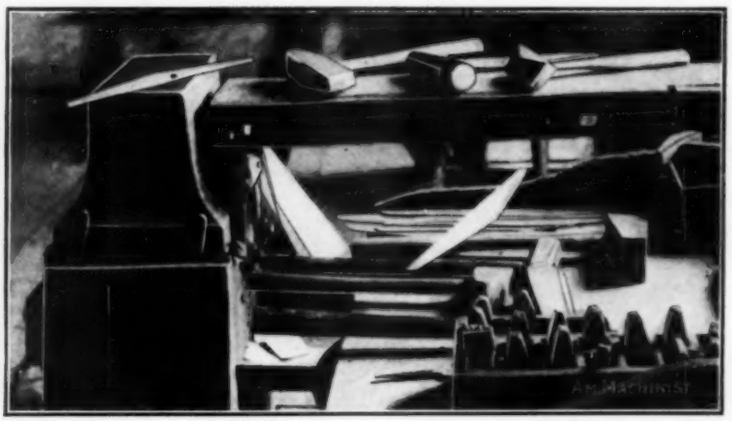


Fig. 11. Hammers, Straightedges and Stamps Used

Fig. 12. Testing a Large Saw

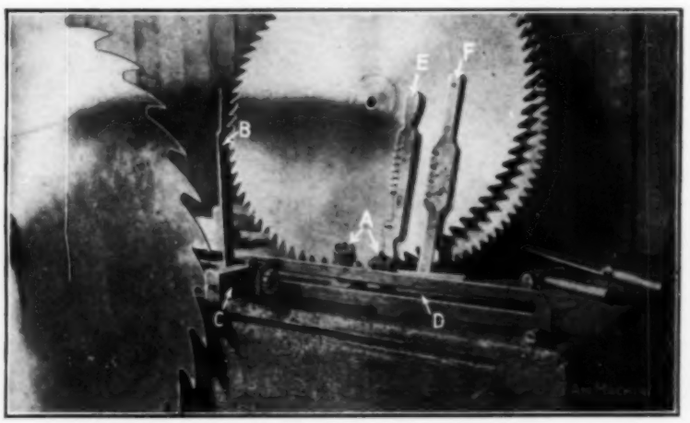


Fig. 13. Tooth-swagging and Setting Tools

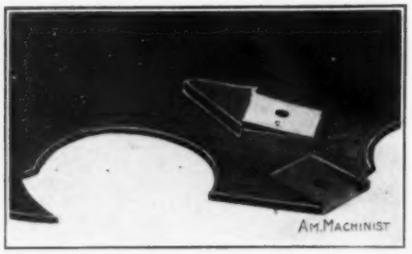


FIG. 14. METHOD OF REPLACING BROKEN TEETH

FIG. 15. INSERTED-TOOTH PARTS IN VARIOUS STAGES

MAKING INSERTED TEETH

Besides the blade itself, the parts of an inserted-tooth saw consist of teeth or bits, and holders or shanks, the latter also being called springs in some cases. The bits are drop-forged in pairs, while the shanks are punched out of sheet metal. Samples of both bits and shanks are shown in various stages of finish in Fig. 15. Two of the bits as forged are shown at *A* and below them are two with the flash trimmed off; *B* shows a piece of scrap from which shanks have been blanked and just below it a number of shanks are shown.

Of course, it must be understood that of the many types of inserted teeth on the market, such as the chisel-tooth, Brookes, Goulding, and others, only a few will be taken as examples and the machines and tools shown do not represent more than a fraction of the shop equipment. Only the principal operations will be shown in any case, and Fig. 16 may be taken as typical of a chisel-tooth bit and spring in position in a saw.

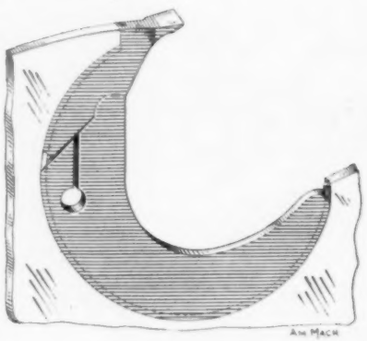


FIG. 16. PARTS OF INSERTED CHISEL TOOTH

MILLING THE SHANKS

With the exception of the drilling, most of the operations on the type of shanks shown in the halftone, are done on the battery of millers shown in Figs. 17 and 18, all of which were made in the shop.

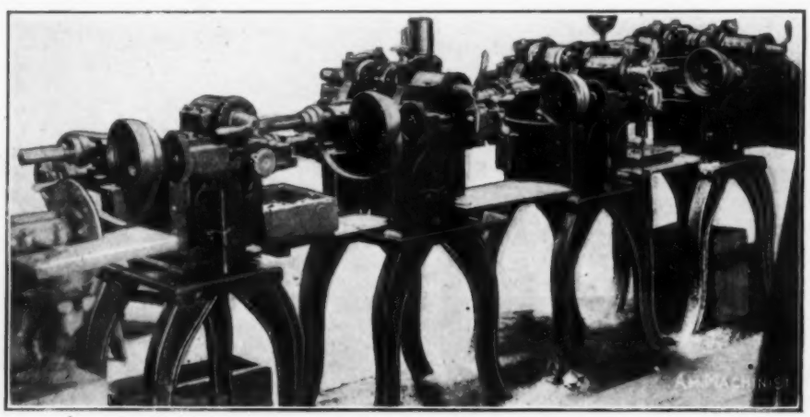


FIG. 17. BATTERY OF SPECIAL MILLERS FOR SAW-TOOTH PARTS

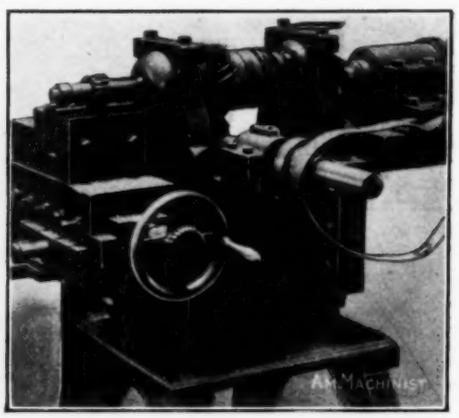


FIG. 18. VIEW OF ONE OF THE MILLERS

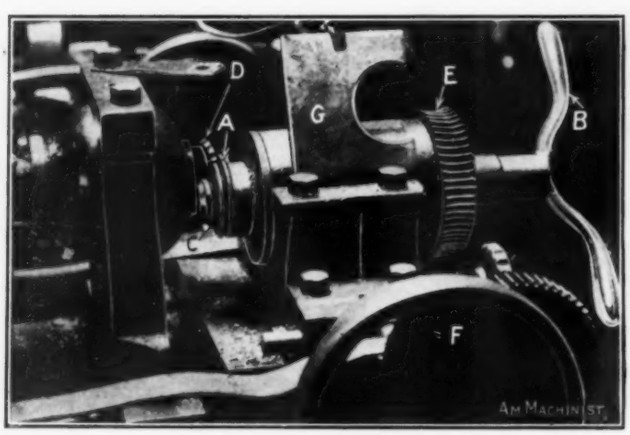


FIG. 19. MILLING V-GROOVE IN SHANKS

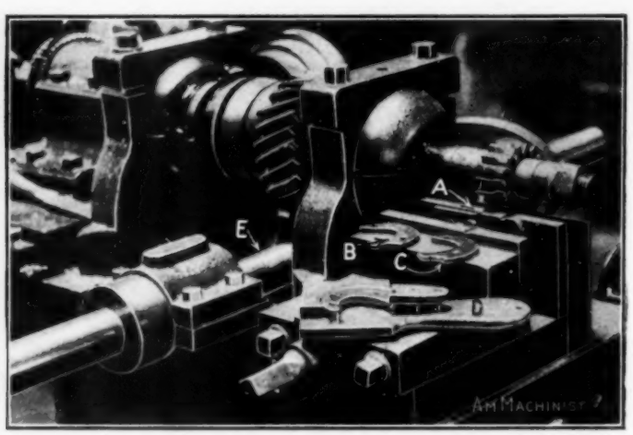


FIG. 20. MILLING THE HEADS OF SHANKS

All the millers are double ended and are run from one shaft which passes crosswise through the four, so that there are practically eight millers with a single drive, in the group.

The first halftone, Fig. 17, shows the entire group, while Fig. 18 shows a closer view of the left-hand machine, taken from the opposite side. The formed mill at the left is used to mill the heads of the shanks and the right-hand end of the shank being given by means of a worm gear *E* on the spindle of the fixture, which is run by means of a worm and gears from the belted pulley *F*. The milled grooves are tested by inserting the shanks in the gage *G*, shown resting on top of the fixture.

Milling the Shank Heads

The shank head or part that comes in contact with the bit, is next milled using

It will be seen from the halftone that the miller spindle carrying the cutters is run by spiral gears direct from the main driving shaft *E*.

The slit sawed in the shank head in order to give a certain amount of spring is cut on one of the battery of millers, as shown in Fig. 21. The fixture for holding the shank is simply a recessed block into which the shank fits at *A* and is clamped in by the lever *B*.

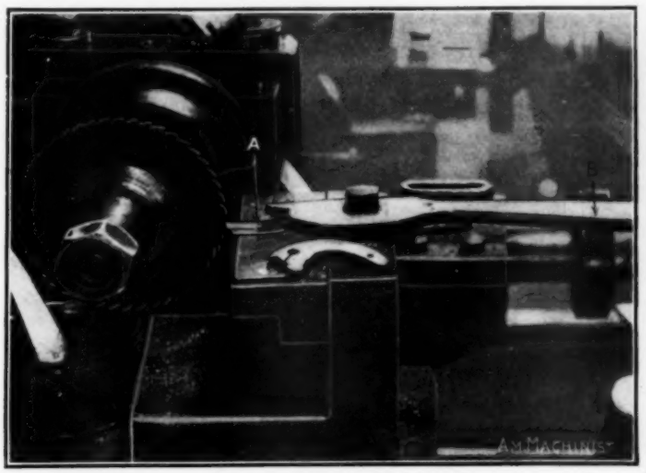


Fig. 21. Slitting the Heads

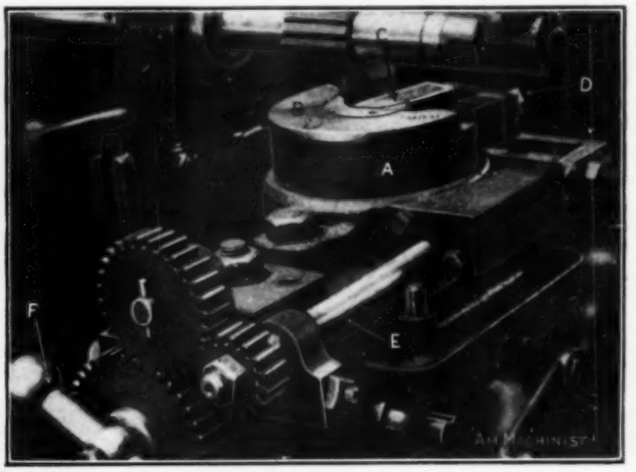


Fig. 22. Milling the Swell

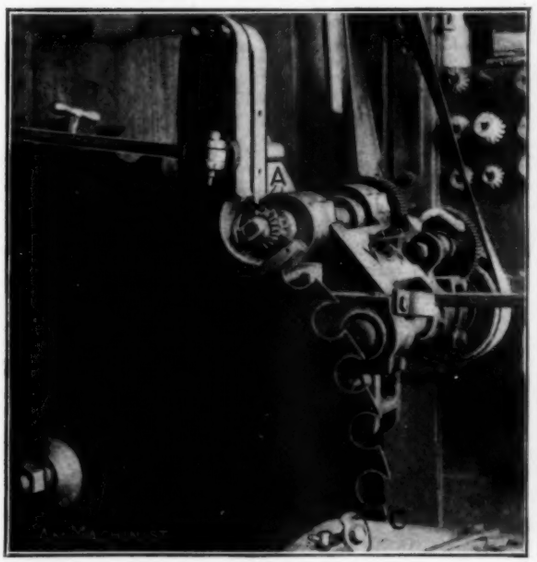


Fig. 23. Beveling Saws for Inserted Teeth

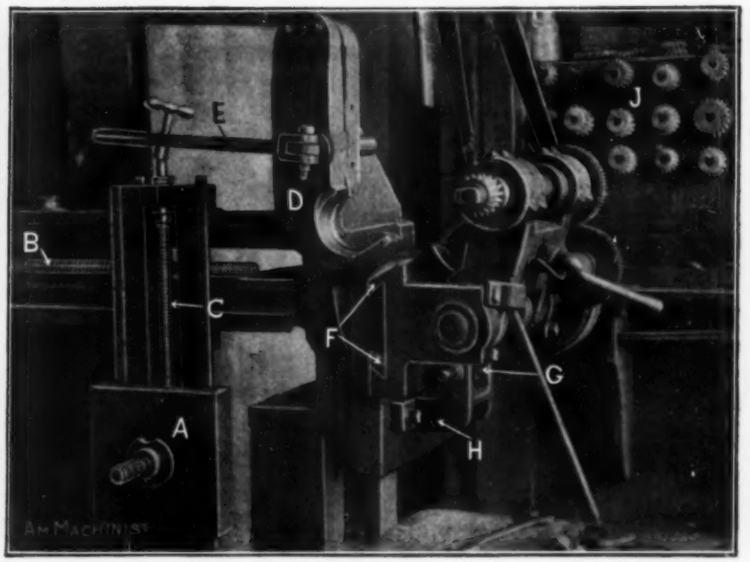


Fig. 24. Details of the Mechanism of the Beveling Machine

machine is set up to mill the V-groove, in the outside edge of the shank, which holds it in place in the saw. Both of these operations are shown enlarged in the next two illustrations.

Grooving the Shanks

The shank to be grooved is located at *A*, Fig. 19, by the drilled holes, and is clamped in place by turning the handle *B*, which draws up the washer *C*. A V-shaped mill *D*, cuts the groove as the shank is revolved, the motion of the

the opposite end of the same machine, as shown in Fig. 20. The shank is placed between the vise jaws at *A* in a V-edged locating plate over which the milled groove fits. The lower end of the shank butts against a stop, so that when the head is milled with a formed cutter, as shown, all shanks so milled will be of the same size.

A shank before and after the head is milled, is shown at *B* and *C* respectively, and the gage used for testing the correctness of the milling is shown at *D*.

Milling Sides of Shanks

By referring to Fig. 15, it will be seen that the last three shanks on the right have a swell on the inside near the heads. This swell has a curve similar to the outside of the shank and is obtained by milling away the sides of the shank to suit, as shown in Fig. 22.

The shank to be milled is held in the carrier *A* by clamping it against the V-edge of the plate *B*. The block *C* works like the jaw of a vise and presses the

shank against the plate as the screw *D* is tightened.

A rotary motion is given to the carrier, in order to mill the swell to the proper curve, by means of a worm gear on the bottom of the carrier block and a worm on the shaft *E*, which is operated by turning the ball-crank *F*.

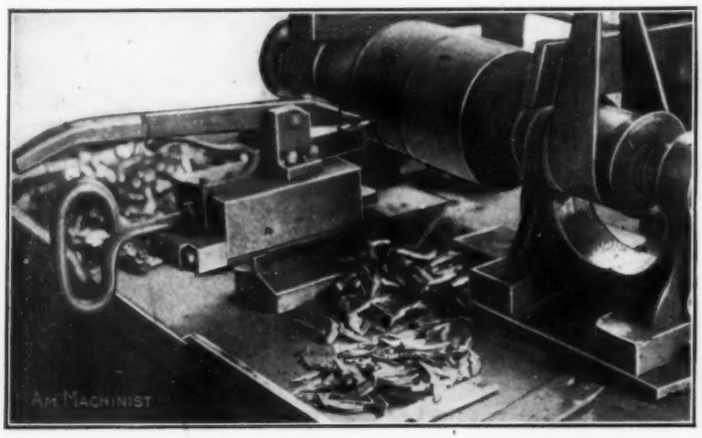


FIG. 25. GRINDING SIDES OF BIT BODIES

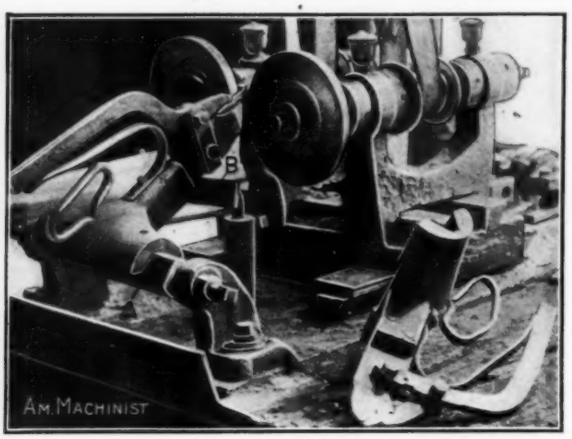


FIG. 26. GRINDING SIDES OF CHISEL ENDS

BEVELING THE SAWS

The saws are beveled out in the punched spaces to receive the bits and shanks, in the special miller shown in Fig. 23. This, like most of the other machines used, was designed and built in the shop.

Two bevel mills *A*, set a little distance apart, are used on the arbor, and after the saw has been securely clamped by the lever *B*, these mills are swung into position and fed into each side of the circular opening in turn, stops being used to secure the proper amount of movement crosswise.

The bevel is tested by using the gage *C*, which has a V-groove in the rim, exactly the size and radius of that in the teeth to be inserted.

The miller with the carriage thrown back and the saw removed is shown in Fig. 24. This halftone clearly shows the way the saw carrier *A* may be adjusted both horizontally and vertically by means of the screws *B* and *C*.

The vise *D* is clamped by the eccentric lever *E*, which may be adjusted for different thicknesses of saws. The stops which control the side movement of the carriage on the ways *F*, are shown at *G*, a setscrew being placed in each side of the bracket *H* between which a block fastened to the carriage works. Several sets of bevel mills used for different sized teeth are shown on the board at *J*.

MAKING THE BITS

The bits are drop-forged in pairs, as previously stated; next the flash is trimmed off in a punch press in the usual way and then the bits are ready for sharpening. Different models of grinders are used in the shop and represent various stages in the advancement of design, covering a long period of time, but only one set covering the process will be shown.

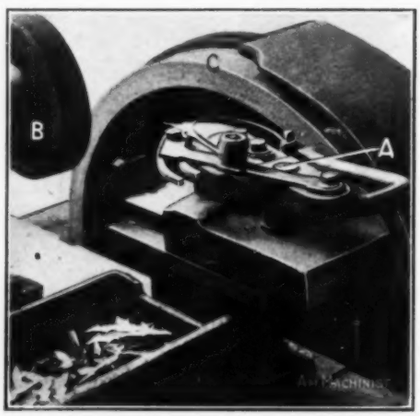


FIG. 27. GRINDING CUTTING EDGE OF BITS

GRINDING

The way the body of the bit is ground on the sides is shown in Fig. 25. The bit is held between the jaws of the fixture at *A*, with the chisel point toward the operator, and pushed in between the grinding wheels *B* and *C*. A stop is used to prevent the carriage being pushed in too far.

The handle *D*, used by the operator to push the fixture out or in, is so placed that the lever *E* holding the bit, may be reached with the thumb without removing the fingers from the loop. Made in this way very rapid work may be done with little effort. Adjustment of the grinding wheels with relation to each other and to the work fixture, is obtained by having each grinding head mounted on a slide so that it may be moved by a handwheel as desired.

The sides of the chisel points are ground to gage and also given the correct clearance, as shown in Fig. 26. The bit is held in a way similar to the one just shown, but instead of the fixture sliding, it is rocked on the support *A*, an adjustable stop *B* keeping the work from being pushed down too far. The heads carrying the disk wheels are adjustable on the cross slide as will be seen by inspection.

The cutting edge of the bit is ground in the machine shown in Fig. 27, the holding fixture being somewhat similar to the two just described, but made flat, instead of vertical, to swing on a center at *A*, so that the chisel point can be ground on both sides of the edge. The part that is on the inside, when the bit is in the saw, is ground by swinging the fixture over to the disk wheel *B* and the other part is ground on the hollow wheel *C*.

In order to get the proper edge on the bit and keep the wheel wearing true, the grinder head carrying the large hollow wheel is made so that it moves up and down a limited amount, and as the wheel runs, it automatically keeps itself true and also grinds a square edge on the bit.

In gathering material for this article, especial thanks are due to General Manager Humphreys and Factory Manager Baldwin for their courtesy and interest.

All accidents due to negligence are largely preventable. It is pointed out in a paper presented to the Pittsburg Foundrymen's Association that the means of prevention lie in the direction of (1) proper design and construction of plant and appliances, (2) care on the part of employers and employees, and (3) the use of safety devices. It must not be overlooked that in the past employers have concentrated their attention on the machinery and equipment of their plants and overlooked the most important element of all, the care of the human machine. Although considerable stress is laid upon the proper design and installation of protective devices, it is believed that at least two-thirds of the accidents which happen in any plant are due to carelessness on the part of the worker and negligence for which the employer and employee are responsible.

Manufacturing Automobiles in Iowa

Western Correspondence

The methods of a western shop where cylinders are machined by a series of operations which include bellmouthing of the bore, for the purpose of locating in fixtures, turning of the neck, boring and grinding in a lathe with tools carried by a special turret.

Surfacing and boring aluminum crank cases on an indexing fixture applied to the table of a plain miller.

Machining spiders and rear axle parts.

One of the numerous industries carried on in the city of Waterloo, Iowa, is the manufacture of automobiles, the largest concern in this line in the community being the Mason Motor Co., some of whose methods are represented in the illustrations shown. Figs. 1 to 6 inclusive illustrate operations performed in the process of machining cylinders for double-opposed engines.

First Steps in Cylinder Work

The first operation on these cylinders after they are tested hydraulically, is shown in Fig. 1 and consists in bellmouthing the end to provide a locating surface for future steps in the machining process. The fixture in which the casting is held upright is shown in place on the table of a Foote-Burt drill and is made up of an angle plate with a clamping device attached at the top.

The outer clamp is semicircular and is secured by two keys which are driven through slots in the ends of a pair of studs over which the strap is slipped freely. Two setscrews are tapped through the strap and rear portion of the clamp to center and secure the work.

The bellmouthing tool is a cutter head with four inserted blades ground to the desired angle and readily adjustable to diameter. The cutter blades are secured in their seats in the head by a plate attached to the face of the tool by four screws.

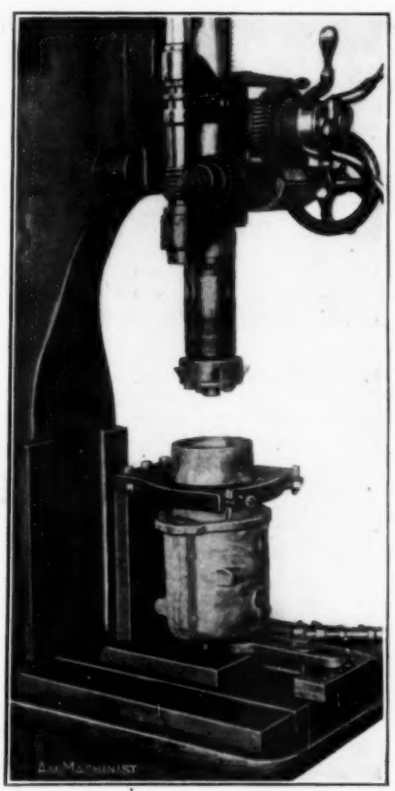


FIG. 1. BELL-MOUTHING OPERATION

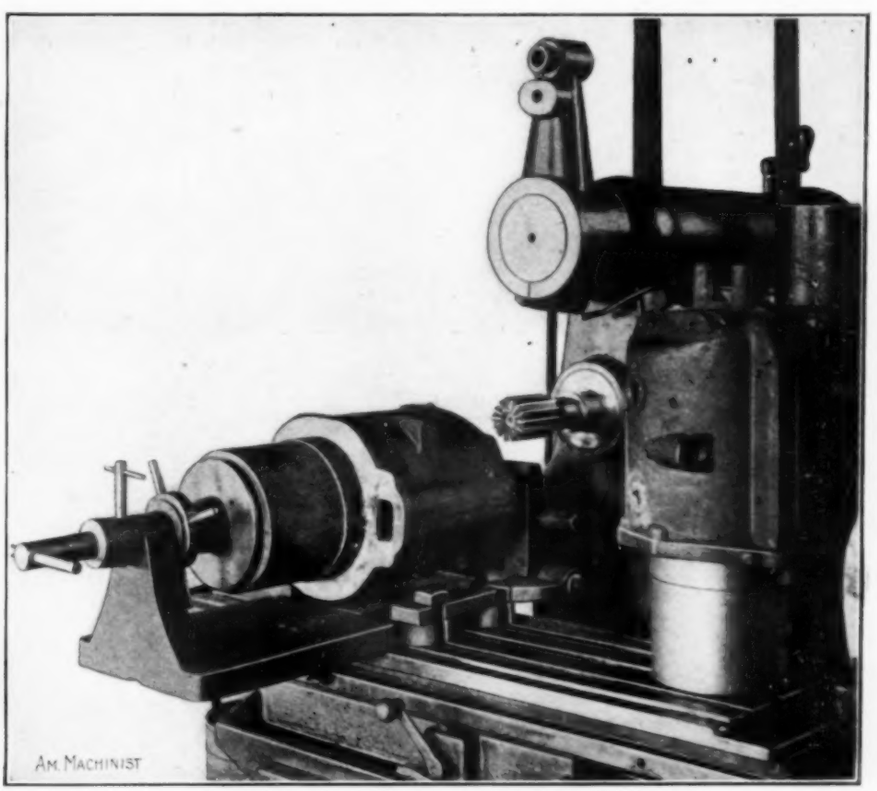


FIG. 2. MILLING SEAT ON CYLINDER FOR ROCKER ARM

A Milling Operation

In Fig. 2 is illustrated a fixture on an Oesterlein miller for holding the cylinder crosswise of the table while the seat for attaching the rocker arm is machined with a shank mill.

The fixture has a pair of V-jaws at the rear to hold the closed end of the cylinder by the two lugs on that end which later on receive the valve stems, and these jaws are operated by a right-and-left-hand screw, the squared end of which is shown projecting to the right of the fixture. The open end of the cylinder is supported by a cone disk threaded on a short mandrel or plunger at the front of the fixture.

The exhaust port faces are also milled on this machine with the work held in a fixture of different design.

Turning the Cylinder Necks

The ends of the cylinders where they enter the crank case have to be turned to diameter and although only a short portion of the neck is required to be exact size to fit the opening bored in the crank-case wall, it is customary here to turn the whole length of the neck, and the cylindrical surface thus provided is utilized in a later operation for locating the work.

The operation illustrated in Fig. 3 is the rough turning of the cylinder, in which process enough material is left for a finishing cut to be taken later to fit the shoulder at the base of the neck to the bored opening in the crank case.

The turning and facing are accomplished in an American geared-head lathe fitted with a fixture which screws on the spindle nose and holds the cylinder by

the closed end, the bellmouthed, open end running on a large pipe center.

The two lugs cast on the end of the cylinder are entered in a rectangular opening across the face of the fixture on the spindle nose and, with the other end supported as indicated, the turning and facing cuts are taken without difficulty.

An Indexing Boring Fixture

Following the rough-turning operation, the cylinders are placed in the fixture illustrated in Fig. 4, which centers them one at a time under the spindle of a Baker Bros. boring machine.

The turned portions of the cylinders fit in openings bored half in the fixture and half in the removable clamps which are secured by taper keys, as represented. The fixture is attached to a table which is adapted to be indexed to three different positions along the knee of the machine. There are three bushed holes in the sliding table which are accurately spaced to allow each cylinder to be brought in turn exactly central with the machine spindle when the index pin is inserted.

During the time that the cutter head is at work in the first cylinder the operator can place two other castings in position, and while the third cylinder is being bored he can remove the other two and put others in their places. The table can then be indexed back one step at a time for the boring of these two castings, and the loading and unloading processes carried along in this way without loss of time. Two cutter heads are used

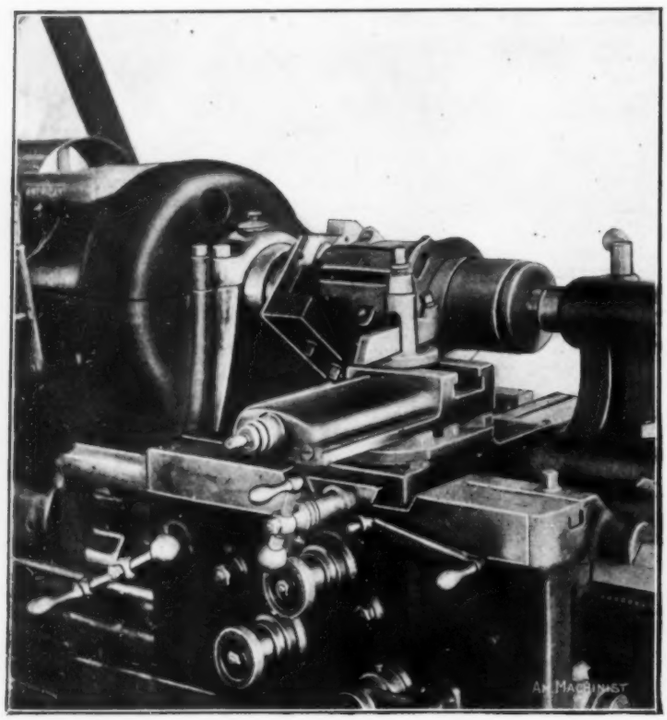


Fig. 3. Turning Cylinder Necks

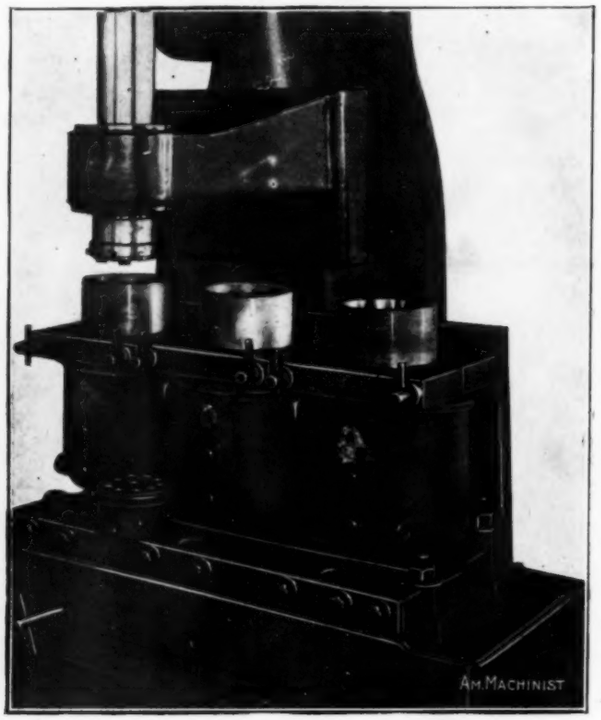


Fig. 4. Boring Cylinders

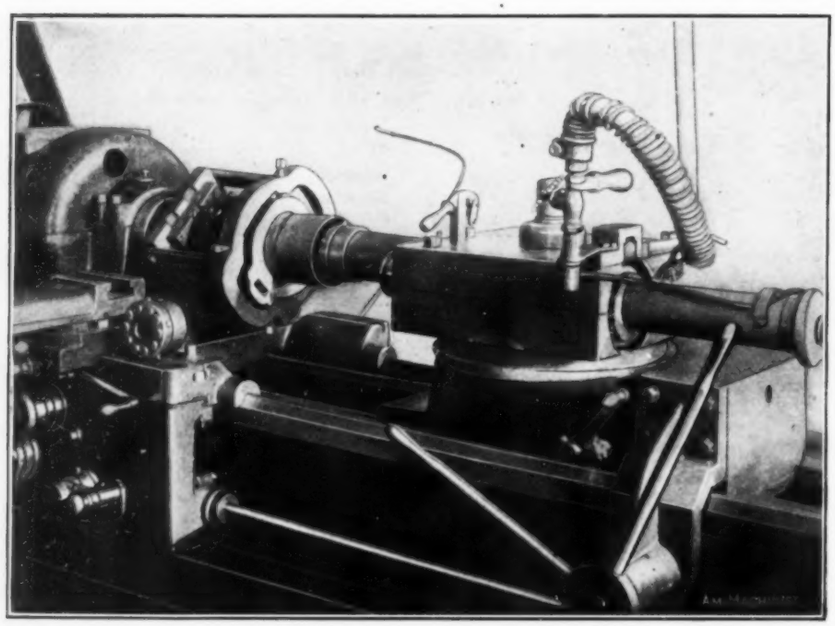


Fig. 5. A Special Turret-boring Device for Cylinders

of the type shown in place on the spindle and upon the table of the machine.

Finish Boring and Grinding

From the boring machine the cylinders go back to the lathe in which they were first turned in the manner described, and as they are ground out at this second setting a light finish-boring cut is taken to leave a uniform amount of work for the wheel to do in sizing the bore.

This lathe is equipped with a home-made turret seen in Figs. 5 and 6, which is designed with two working faces, one of which carries a boring bar and the other an internal grinding quill. The holding fixture for the cylinder is somewhat different in design from the fixture used in the rough-turning operation shown in Fig. 3.

In relocating the cylinder for the operations in this second fixture, a large cone center is slipped over the end of the boring bar and run into the mouth of the cylinder to hold it central while the clamp-screws in the fixture are set up to

the work. The center is then removed and a cutter head slipped onto the bar and run through to take a light cut preparatory to the grinding process. At this same setting a tool is put in the post to turn the inner end of the neck true and to exact size to fit the hole in the crank case, and the flange is faced true.

The Grinding Attachment

The nature of the grinding attachment will be seen from Figs. 5 and 6. The spindle for the wheel is carried in a sleeve which is eccentric to a body which fits the hole bored across the turret. The rear end of the spindle projects from the sleeve sufficiently to receive a small flanged pulley which is driven at high speed from an overhead drum. The sleeve is fitted with a wormwheel, and a worm-shaft which extends across the turret top and has a crank handle at the end providing a means of adjusting the eccentric sleeve to set the wheel to the cut.

Water is supplied for the grinding process by means of the pipe leading down to the turret side. As the turret is swung only half way round in shifting from one operation to the next, the hose does not interfere with its manipulation.

It will be noticed by referring again to Fig. 3, that the pipe center used in the process of locating the cylinder for the turning operation, is carried by the tail spindle. The tailstock is used on the lathe only during this operation on the lot of cylinders. When these are all rough turned the tailstock is removed bodily, leaving the shears clear for the handling of the turret. The turret slide remains on the lathe at all times, and is merely drawn back to the end of the bed when the tailstock is in use.

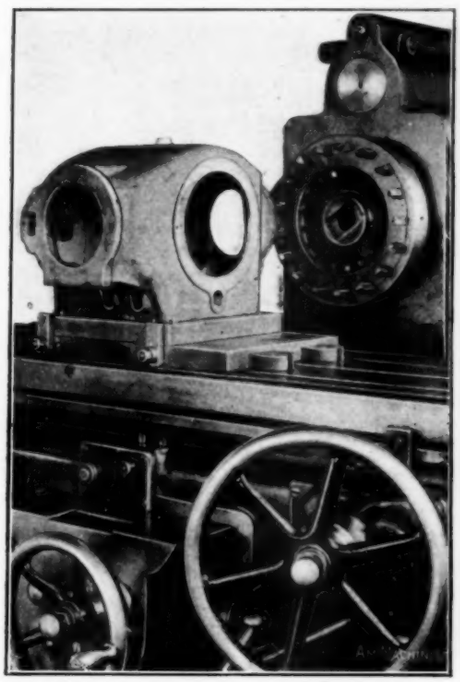


Fig. 7. Milling Fixture

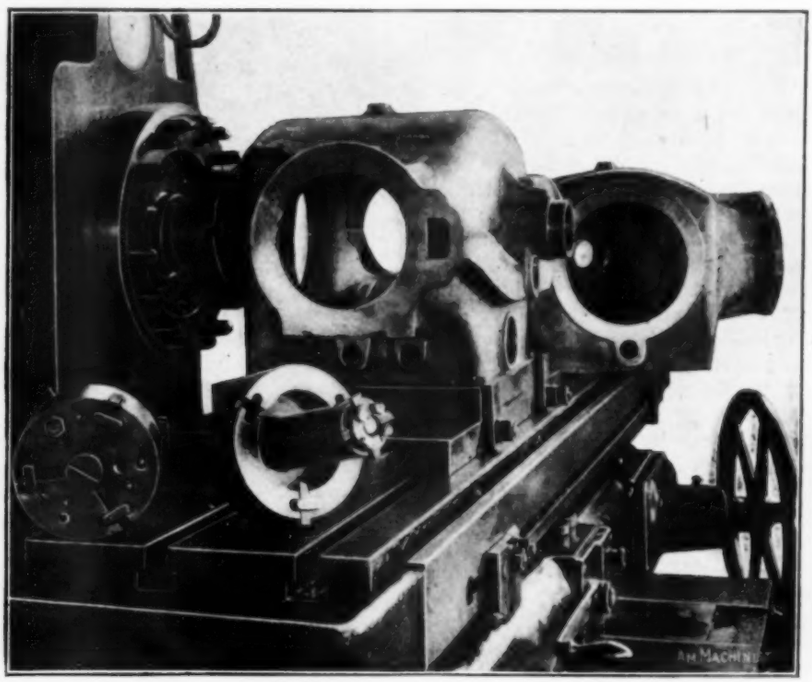


Fig. 8. Tools for Boring Crank Cases on the Miller

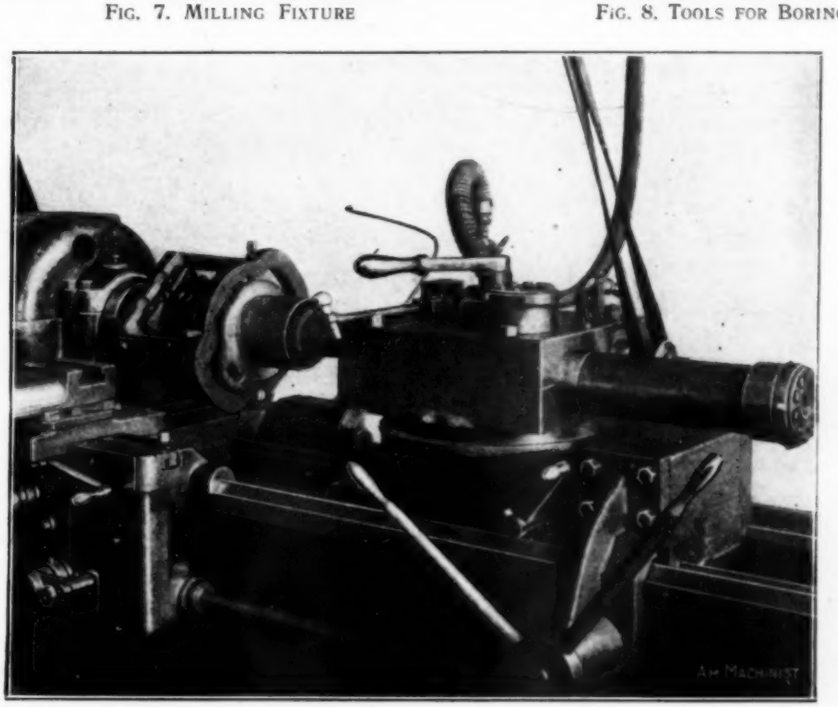


Fig. 6. The Turret Set for the Grinding Operation

Milling Crank Cases

The aluminum crank cases are milled on all flat surfaces, bottom as well as three sides. The casting is first faced across the bottom while held on its side against a fixture which presents the work surface to a large inserted-tooth cutter carried on the spindle of a Brown & Sharpe No. 4 plain miller. It is then placed with its finished base upon the fixture Fig. 7 which has a perfectly square swivel plate to which the work is attached and which is adapted to be indexed upon the base to bring the ends and side of the crank case into position for milling square with one another.

The work is located between a set of stop-pins placed at the corners of the swivel plate, and is held down by a strap inside. The edges of the square plate are finished to come perfectly flush with the front edge of the base plate of the fixture and in place of an index pin or lock-bolt, the swivel plate is set exactly for the different cuts by means

of two steel plates carried upon studs at the front of the fixture. These pieces swing down out of the way when the work is to be indexed, and when swung back and tightened by their nuts they bring the edge of the swivel plate into perfect register with the base plate as shown in the illustration.

The cutter head is made with coarsely spaced inserted teeth of high-speed steel which are held in place with setscrews tapped in from the recessed center of the head. The openings for the teeth are milled into the periphery of the head and the whole is inclosed with a steel ring.

Boring on the Miller

The same indexing fixture is used for holding the crank case for boring the openings in opposite faces to receive the cylinders and for boring the seat for the crank-case cover. It is the latter operation that is shown under way in Fig. 8.

There is still another portion of the casting which is machined on this boring fixture, namely the hub for the crankshaft end-bearing. This hub is on the front of the crank case in the engraving and, as will be noted, it requires boring out for the shaft bearing, and turning externally to receive the water pump, which here is located right at the end of the shaft to do away with driving gears. The fixture when used for boring purposes has to be set to four different positions, that is, indexed all the way round instead of to three points only as in the milling process.

The Boring Tools

The boring tools are clearly represented in Fig. 8. They are put into place as required for the various operations without disturbing the large inserted face mill on the nose of the milled spindle.

The heads each carry three roughing tools at the front, and a single tool for taking a finishing cut is inserted at the rear, sufficient space intervening to permit the roughers to pass clear through the work before the finishing tool starts its cut. The cutters are held in their seats by eye-bolts drawn back by nuts on the opposite face, and are adjusted outwardly to the cut by a conical-headed, threaded plug at the center.

The combined boring tool and hollow mill for finishing the bore and exterior of the hub projecting from the side of the crank case, will be seen in the foreground, of Fig. 8. The hollow mill is a boring head with two cutters removed and with the remaining tool turned over to bring the point toward the center. This head is secured to the boring bar so that the outside and inside of the hub are finished before the bar is withdrawn.

Connecting Rod Jigs

A pair of jigs for drilling, boring and reaming forged connecting rods under a Moline four-spindle machine is seen in Fig. 9.

The rods are first placed under a light driller and ½-in. holes put through both ends to lighten the work of the larger tools. The two jigs shown are then used on the four-spindle machine where the holes are enlarged nearly to size. These jigs are fitted with equalizing or centering devices which may be seen upon close inspection of the illustration.

The arrangement consists of a pair of sliding V's connected by a rocker arm pivoted at the center of the jig, so that when one V is slid outwardly into contact with one of the connecting-rod hubs, the other moves in unison but in the opposite direction and contacts with the boss at the other end of the rod. This action against the inner sides of the rod bosses sets the rod at once in central position in the jig, and two taper keys at

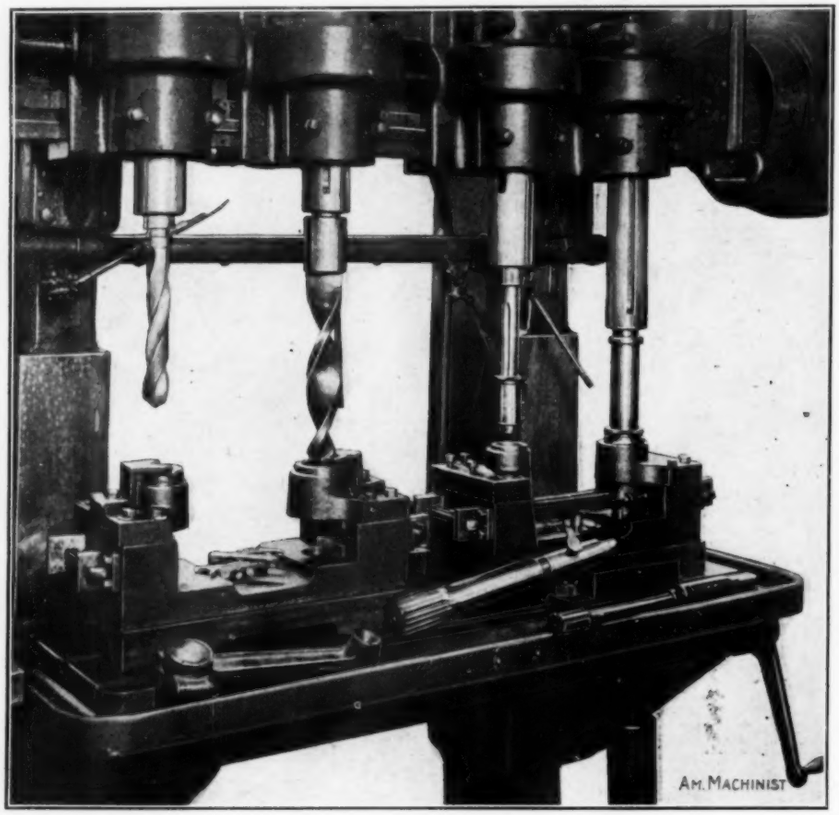


Fig. 9. Connecting-rod Jigs

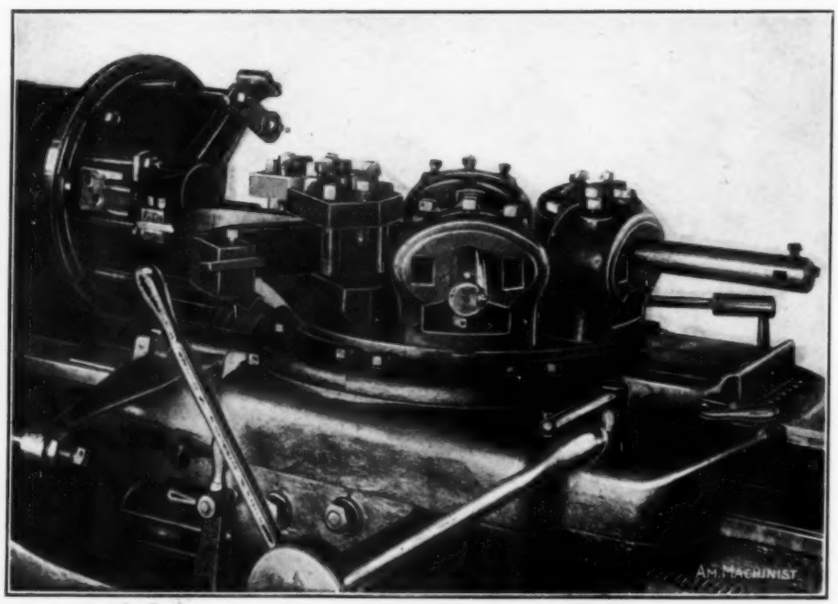


Fig. 10. Tools for Facing and Shouldering Rear-axle Spiders

the ends of the jig are then driven in to force the gripping jaws against the outer ends of the rod and hold it fast.

Boring and Reaming

After all the rods in a lot have been drilled, one jig is removed from the table and the further work of boring and reaming is carried along with a single jig which is positioned alternately under each pair of spindles.

The tools are then actually set with two boring bars in the left-hand spindles, and two reamers in the remaining spindles to the right, although this is not the exact arrangement represented in Fig. 9 which was photographed without the removal of the twist drills.

To facilitate the boring and reaming process, a jig guide and suitable stops are fastened to the table so that the operator may set the jig under the boring bars and then under the reamers with no loss of time and with the assurance that the tools will pass freely into the guide bushings as soon as the jig is slid into contact with its stops. The boring bars carry their own bushings which fit the fixed bushings through which the reamers pass in sizing the holes.

Machining Rear Axle Spiders

Two operations in the machining of rear axle spiders are illustrated in Figs. 10 and 11 which show the method of handling these parts on the Jones & Lamson flat turret lathe.

These spiders are made right and left hand with the ends of the arms faced as indicated in Fig. 12 so that the external shoulders formed on one spider will fit the internal shoulders formed on the opposite spider. In one case the operation consists in turning the outside of the three arms down to a certain diameter, while the opposite spider must have its corresponding surfaces turned out from the inside to receive the shoulders turned down on the mating member.

In Fig. 10 a spider is chucked on a faceplate fixture which holds its inner face out for the turning down of the joint face on the three arms. The tools for this cut are shown on the turret. One of them turns off the seat at the end of the arm, the other is a square point for cutting the shoulder perfectly square.

Other holders on the turret carry tools for facing the end of the hub and for boring it out to receive a roller bearing, about 0.010 in. being left in this operation for reaming to size under a driller after the parts forming the half axle have been assembled.

Second Operations

In putting through a lot of spiders, half of the parts are machined with the male joint as shown in Fig. 10, the other half are finished out as female members with the turret tools already described. The next operation for both right and left spiders is then accomplished by turning the work over to bring the shoulders against a circular ledge on the faceplate fixture, as in Fig. 11. This causes the spider to run true with the joint face and in this position the outer end of the hub is bored to receive the end of the rear axle tube as shown in Fig. 12. This hole is bored carefully to a definite size to allow the tube to be pressed nicely into place.

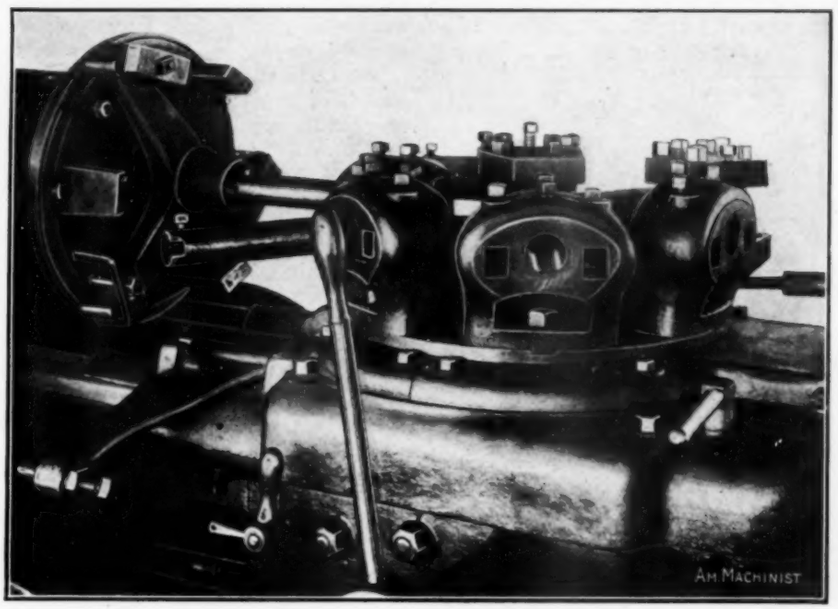


Fig. 11. Tools for Boring Rear-axle Spiders

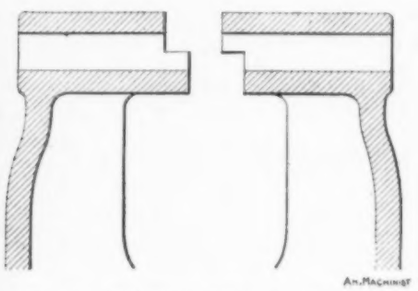


Fig. 12. Sections through Ends of Spiders for Rear Axle

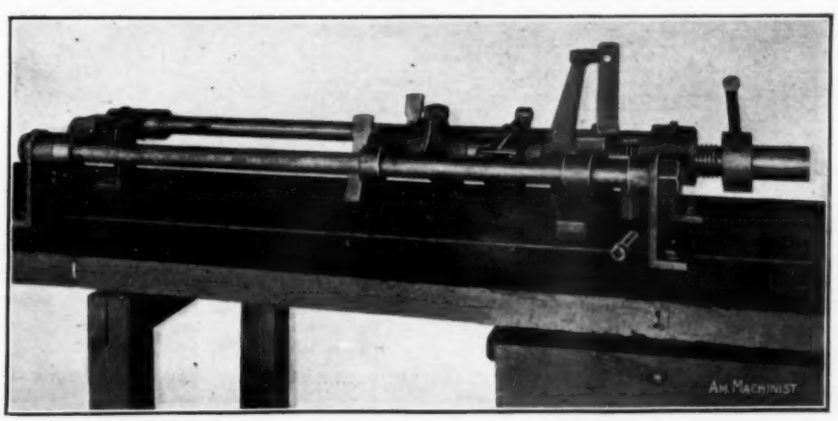


Fig. 13. Bench Screw Press for Assembling Rear-axle Parts

An Assembling Press

The horizontal press on the bench in Fig. 13, was constructed for assembling rear axle parts. The tube with its various members in place is shown resting against an abutment which is backed up by a couple of keys placed in slots across the tie-rods of the press. The short screw has all the travel necessary as the rear abutment for the work may be set at any point along the rods to conform to the requirements of the parts being assembled.

According to a bulletin just issued by the Census Bureau, the average number of wage earners engaged in car and general ship construction and repairs by steam railroad companies during 1909 was 282,200, an increase of 62½ per cent. during the ten years elapsing since the preceding census.

An Additional Screw Thread Standard Needed*

By Luther D. Burlingame†

In a contribution to the meeting of the American Society of Mechanical Engineers on the subject of tap and screw threads on March 12 the suggestions which have been made from time to time for new or different screw standards were reviewed. These include the contributions on this subject by Major William Arching in 1885, John L. Gill, Jr., in 1887, Charles P. Tyler in 1902, Charles T. Porter in the same year, as well as the work of the British Engineers for the standard fine screw thread. It also includes the A. L. A. M. thread of 1906 and the work of the Railway Master Mechanics' Association in 1907 and 1908 and the A. S. M. E. paper by Amasa Trowbridge entitled "Comparison of the Screw Thread Standard."

After giving some study to Mr. Trowbridge's paper, it seemed to me that it was an opportune time to present an intermediate standard to cover not only the need pointed out by him, but to meet the whole situation by extending the A. S. M. E. standard and producing an intermediate standard which could be used in connection with the U. S. and with the automobile standards, not with the idea of displacing either of these, but in order that the varying needs might all be covered with authorized and well established standards and thus reduce to a minimum the need of using special threads.

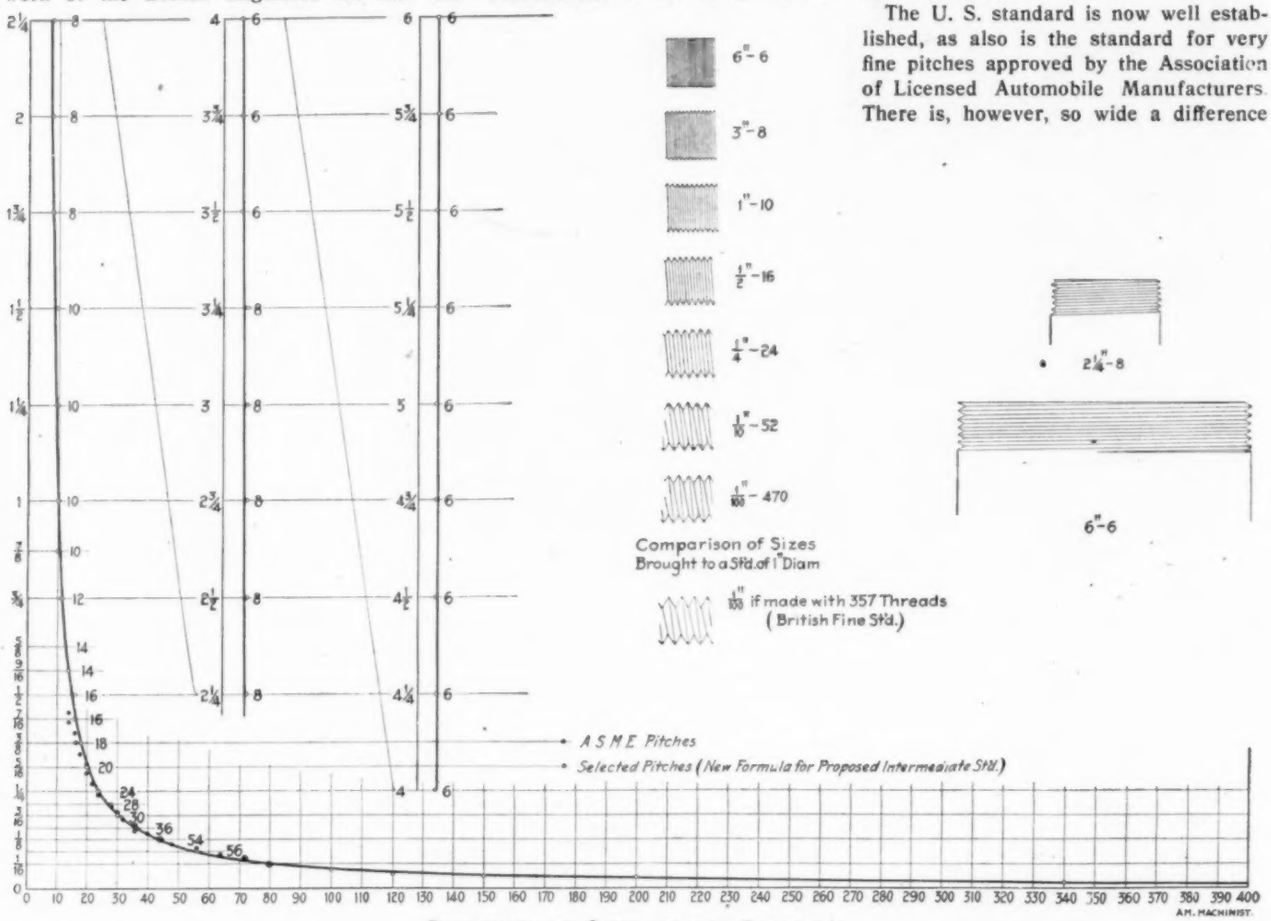
With this thought in view, I worked out a formula and presented it at the Detroit meeting in 1908 as a discussion of Mr. Trowbridge's paper, this discussion appearing at page 375, volume 30 of the "Transactions of the A. S. M. E." This formula gives threads practically coinciding with the adopted A. S. M. E. standard within the range for which that standard provides, and in addition provides for screws down to the smallest watch screws, 0.01 in. in diameter, and also up to screws 6 in. in diameter, and gives results closely approximating the pitches used for screws by many leading manufacturers at the present time.

It is believed that the more refined and exacting needs of modern manufacture will still further increase the demand for such a proportion of screw threads and that the adoption of such a standard would be of help in bringing about a uniformity of practice and avoiding the many varieties of threads now being used because there is no standard. If such a standard should be adopted it would connect onto the present series of sizes of the A. S. M. E. standard and give a practical intermediate series of pitches which would, I believe, meet the needs I have here pointed out.

The accompanying diagram gives a comparison of the A. S. M. E. standard pitches with the proposed intermediate standard, while the table gives a comparison of a number of well established standards in use both at home and abroad, together with some suggested standards not yet adopted, including that proposed by the author.

The U. S. standard is now well established, as also is the standard for very fine pitches approved by the Association of Licensed Automobile Manufacturers. There is, however, so wide a difference between these there is a large middle ground in the needs of general machine work which would be better covered by a standard coming between these two extremes. The fact that a thorough study of the situation by a competent committee in Great Britain has shown the existence of such a need gives confidence in urging that a similar need should be provided for in this country, and it is hoped that steps may be taken to bring this about.

I appreciate the general feeling of hesitation in taking up any proposition which would appear to add to the number of kinds of threads in use, but believe the importance of this matter justifies its being pressed until the needed action is taken.



Comparison of Screw-thread Standards

*Read before the New York monthly meeting of the American Society of Mechanical Engineers.

†Chief draftsman, Brown & Sharpe Manufacturing Co.

Diameter of Screw		U. S. Standard $P=\frac{\sqrt{16D+10}-2.909}{16.64}$ or $P=\frac{}{.24\sqrt{D+.625}-.175}$		Whitworth Standard		British Fine Std. ¼ to and inc. 1 in. $P=\frac{\sqrt[3]{D^3}}{10}$ Above 1 in. $P=\frac{\sqrt[3]{D^3}}{10}$		Amer. Licensed Auto. Mfg. Std.		Amer. Soc. of M. E. Std. $P=\frac{D+0.02}{6.5}$		Metric Screws Adopted in France, 1894 S. J. Standard First proposed by The National Soc. for the encouragement of industry of France.		Bond Standard (Proposed) $P=0.23\sqrt{D+0.625}-0.175$		Lewis Std. (Proposed) $P=\frac{0.22}{\sqrt{D+0.25}-0.11}$		Brown & Sharpe Practice	Watch Screws Taken from Amer. Practice	Pratt & Whitney Practice	Recommended by Chas. T. Porter	New Intermediate Standard $P=\frac{D}{5.5D+4.7}$ $N=5.5+\frac{4.7}{D}$		$N=5.5+\frac{4}{D}$
Decimal	Fractional	Threads per Inch		Th'ds per Inch		Threads per Inch		Threads per Inch		Threads per Inch		Appr. Th'ds per In.		Threads per Inch		Th'ds per Inch		Th'ds per Inch		Th'ds per Inch		Th'ds per Inch		Threads per Inch		
		By Formula	Selected	By Formula	Selected	By Formula	Selected	By Formula	Selected	By Formula	Selected	By Formula	Selected	By Formula	Selected	By Formula	Selected	Selected	Selected	Selected	Selected	Selected	Selected	By Formula	Select'd	
0.010		60.0		..	....		357	....	....	216.7	....		357	120.3	....	459	....	....	375	....	....	475.5	470	400
0.011	..	.....		..	....		322	....	....	209.7	....		322	.....	....	.....	....	....	.....	....	....	432.8	...	...
0.013	..	.....		..	....		286	....	....	197.0	....		286	.....	....	.....	....	....	.....	....	....	367.0	...	...
0.014	..	.....		..	....		...	....	....	191.2	....		...	.....	....	.....	....	....	.....	....	....	341.2	340	...
0.015	..	.....		..	....		256	....	....	185.7	....		256	.....	....	.....	....	....	320	....	....	318.9	...	...
0.017	..	.....		..	....		233	....	....	175.7	....		233	.....	....	.....	....	....	.....	....	....	282.0	...	...
0.019	..	.....		..	....		213	....	....	166.7	....		213	.....	....	.....	....	....	240	....	....	253.9	250	...
0.021	..	.....		..	....		182	....	....	158.5			182	.....	....	.....	....	....	.....	....	....	229.3	...	...
0.024	..	.....		..	....		170	....	....	147.7	....		170	.....	....	.....	....	....	200	....	....	201.3	200	...
0.028	..	.....		..	....		149	....	....	135.4	....		149	.....	....	.....	....	....	.....	....	....	173.4	...	...
0.031	..	.....		..	....		133	....	....	127.4	....		133	.....	....	.....	....	....	.....	....	....	157.1	150	...
0.035	..	.....		..	....		120	....	....	118.2	....		120	.....	....	.....	....	....	.....	....	....	139.8	...	...
0.039	..	.....		..	....		110	....	....	110.2	....		110	.....	....	.....	....	....	.....	....	....	126.0	120	...
0.042	..	.....		..	....		...	....	....	104.8	....		...	.....	....	.....	....	....	120	....	....	117.4	...	...
0.047	..	.....		..	....		102	....	....	97.0	....		102	.....	....	.....	....	....	.....	....	....	105.5	102	...
0.051	..	.....		..	....		91	....	....	91.5	....		91	.....	....	.....	....	....	.....	....	....	97.7	...	...
0.059	..	.....		..	....		82	....	....	82.3	....		82	.....	....	.....	....	....	.....	....	....	85.2	...	...
0.060	..	42.5		..	....		...	....	....	81.2	80		...	65.7	....	81.1	....	....	.....	....	....	83.8	80	72
0.067	..	.....		..	....		72	....	....	74.7	....		72	.....	....	.....	....	....	.....	....	....	75.7	...	...
0.073	..	.....		..	....		...	....	....	70.0	72		...	.....	....	.....	....	....	.....	....	....	70.0	72	...
0.075	..	.....		..	....		65	....	....	68.4	....		65	.....	....	.....	....	....	.....	....	....	68.2	...	...
0.080	..	.....		..	....		...	....	....	65.0	....		...	.....	....	.....	....	....	52	....	....	64.3	...	...
0.086	..	.....		..	....		...	....	....	61.3	64		...	.....	....	.....	....	....	.....	....	....	60.2	64	...
0.087	..	.....		..	....		59	....	....	60.7	....		59	.....	....	.....	....	64	.....	....	....	59.5	...	...
0.094	3/32	.....		..	....		...	....	....	57.0	....		...	.....	....	.....	....	....	.....	....	50	55.6	56	...
0.098	..	.....		..	....		53	....	....	55.1	....		53	.....	....	.....	....	....	.....	....	....	53.5	...	...
0.099	..	.....		..	....		...	....	....	54.6	56		...	.....	....	.....	....	....	.....	....	....	53.0	56	...
0.100	..	.....		..	....		...	....	....	54.2	....		...	.....	....	.....	....	....	46	....	....	52.5	52	46
0.110	..	.....		..	....		48	....	....	50.0	....		48	.....	....	.....	....	....	.....	....	....	48.2	48	...
0.112	..	.....		..	....		...	....	....	49.2	48		...	.....	....	.....	....	50	.....	....	....	47.5	48	...
0.120	..	.....		..	....		...	....	....	46.6	....		...	.....	....	.....	....	....	43	....	....	44.7	...	...
0.125	⅛	33.3		..	....		...	....	....	44.8	44		...	40.2	....	40.2	....	....	.....	....	38	43.2	44	...
0.126	..	.....		..	....		43	....	....	44.5	....		43	.....	....	.....	....	....	.....	....	....	42.8	...	...
0.138	..	.....		..	....		...	....	....	41.2	40		...	.....	....	.....	....	....	.....	....	....	39.6	40	...
0.140	..	.....		..	....		...	....	....	40.6	....		...	.....	....	.....	....	....	41¼	....	....	39.1	...	...
0.142	..	.....		..	....		38	....	....	40.1	....		38	.....	....	.....	....	....	.....	....	....	38.6	...	...
0.151	..	.....		..	....		...	....	....	38.0	36		...	.....	....	.....	....	....	.....	....	....	36.6	36	...
0.156	5/32	.....		..	....		...	....	....	36.9	....		...	.....	....	.....	....	40	.....	....	33	35.6	36	...
0.160	..	.....		..	....		...	....	....	36.1	....		...	.....	....	.....	....	....	40	....	....	34.9	...	...
0.161	..	.....		..	....		35	....	....	.....	35.9		35	.....	....	.....	....	....	.....	....	....	34.7	...	...
0.164	..	.....		..	....		...	....	....	35.3	36		...	.....	....	.....	....	....	.....	....	....	34.2	36	...
0.177	..	.....		..	....		...	....	....	33.0	32		...	.....	....	.....	....	....	.....	....	....	32.1	32	...
0.180	..	.....		..	....		...	....	....	32.5	....		...	.....	....	.....	....	....	.....	....	....	31.6	...	...
0.185	..	.....		..	....		37	....	....	31.7	....		31	.....	....	.....	....	....	38	....	....	30.9	...	...
0.188	3/16	.....		..	....		...	....	....	31.2	....		...	.....	....	.....	....	40	.....	....	28	30.6	30	...
0.190	..	.....		..	....		...	....	....	30.9	30		...	.....	....	.....	....	....	.....	....	....	30.3	30	...
0.200	..	.....		..	....		...	....	....	29.5	....		...	.....	....	.....	....	....	36	....	....	29.0	...	26
0.209	..	.....		..	....		28	....	....	28.4	....		28	.....	....	.....	....	....	.....	....	....	28.0	...	...
0.216	..	.....		..	....		...	....	....	27.5	28		...	.....	....	.....	....	....	.....	....	....	27.3	28	...
0.219	7/32	.....		..	....		...	....	....	27.2	....		...	.....	....	.....	....	....	.....	....	26	27.0	...	...
0.220	..	.....		..	....		...	....	....	27.1	....		...	.....	....	.....	....	....	.....	....	....	27.0	28	...
0.236	..	.....		..	....		25	....	....	25.4	....		25	.....	....	.....	....	32	32	....	....	25.4	...	...
0.242	..	.....		..	....		...	....	....	24.8	24		...	.....	....	.....	....	....	.....	....	....	24.8	24	...
0.250	¼	20.00	20	..	20	25.2	25	....	28	24.1	....		...	25	....	22	....	24	28	23	24	24.0	24	20
0.268	..	.....	.....	..	.....	.....	.....	.....	.....	22.5	22		...	.....	....	.....	....	.....	.....	.....	.....	23.0	22	...
0.294	..	.....	.....	..	.....	.....	.....	.....	.....	20.7	20		...	.....	....	.....	....	.....	24	.....	.....	21.5	20	...
0.300	..	.....	.....	..	.....	.....	.....	.....	.....	20.3	....		...	.....	....	.....	....	.....	.....	.....	.....	21.2	...	...
0.313	5/16	.....	18	..	18	....	22	....	24	19.5	....		...	.....	....	.....	....	20	.....	....	24	20.5	20	...
0.320	..	.....	.....	..	.....	.....	.....	.....	.....	19.1	20		...	.....	....	.....	....	.....	.....	.....	.....	20.2	20	...
0.346	..	.....	.....	..	.....	.....	.....	.....	.....	17.7	18		...	.....	....	.....	....	.....	.....	.....	.....	19.1	18	...
0.372	..	.....	.....	..	.....	.....	.....	.....	.....	16.6	16		...	.....	....	.....	....	.....	.....	.....	.....	18.1	18	16
0.375	⅜	.....	16	..	16	....	20	....	24	16.5	....		...	.....	....	.....	....	16	.....	....	22	18.0	18	...
0.398	..	.....	.....	..	.....	.....	.....	.....	.....	15.5	16		17	.....	....	.....	....	.....	.....	.....	.....	17.3	16	...
0.400	..	.....	.....	..	.....	.....	.....	.....	.....	15.5	....		...	.....	....	.....	....	.....	20	.....	.....	17.3	...	16
0.424	..	.....	.....	..	.....	.....	.....	.....	.....	14.6	14		...	.....	....	.....	....	.....	.....	.....	.....	16.5	16	...
0.438	7/16	.....	14	..	14	....	18	....	20	14.2	....		...	.....	....	.....	....	14	.....	....	22	16.2	16	...
0.450	..	.....	.....	..	.....	.....	.....	.....	.....	13.8	14		...	.....	....	.....	....	.....	.....	.....	.....	16.0	16	...
0.500	½	12.48	13	..	12	....	16	....	20	12.5	....		...	14.8	....	12.4	....	14	.....	....	20	14.9	16	14
0.563	9/16	.....	12	..	12	....	16	....	18	11.2	....		13	.....	....	.....	....	14	.....	....	20	13.9	14	...
0.625	⅝	.....	11	..	11	....	14	....	18	10.1	....		...	.....	....	.....	....	12	.....	....	18	13	14	...
0.750	¾	.....	10	..	10	....	12	....	16	8.44	....		10	.....	....	.....	....	12	.....	....	18	11.8	12	11

Formula not intended to be used beyond this point

Selected sizes below 1 in. pitches are approximate.

Pitches in next column are approximate translations from metric sizes

COMPARISON OF VARIOUS STANDARDS FOR PITCHES OF SCREW THREADS, BY LUTHER D. BURLINGAME

Compression Springs and Materials

By R. A. Peebles*

It is the purpose of this article to call attention to some of the principal sources of error in commercial, helical, compression springs which have been observed in a long course of testing springs and spring materials.

*Research engineer, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

The design of helical compression springs in which the relation of load to deflection is required to fall within fairly narrow limits is a perpetual source of trouble to the mechanical engineer. However carefully such springs are calculated they show up too strong or too weak in a large percentage of cases when tested.

The demand for springs which can be depended upon to work within very close limits of load for given deflections is becoming greater each year. Large numbers are required for use as piston springs and valve springs in various types of pneumatic controlling and operating devices, in which the working of the apparatus and the safety of human life may wholly depend upon the accuracy of the springs. The increasing use of centrifugal clutches and starting devices also has had a large share in creating this demand.

The theory of helical springs is based upon the laws which govern the elasticity of rods in torsion. These laws are well known and if the physical properties of the material are accurately known and the spring carefully made, the performance will check very closely with the calculations.

Spring Specifications

The Westinghouse company uses thousands of springs yearly and all are purchased under strict specifications. The requirements are in most cases that the load at the compression specified on the drawing vary not over 10 per cent. from that required. In one class of springs used on apparatus where accuracy of adjustment is very essential the variation allowed is 5 per cent.

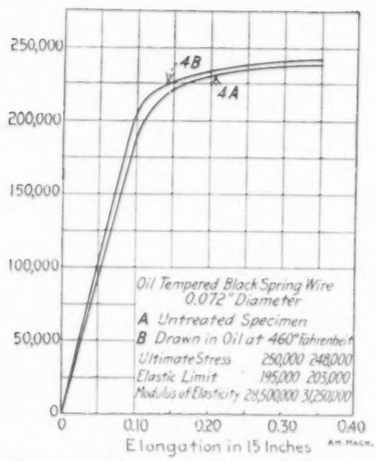


Chart 2. Tension Test on Black Spring Wire

The drawing usually specifies the free height of the spring, the number of turns, the size of wire or bar, and either the outside or inside diameter of the spring according to where it is to be used. The specification provides, however, that the manufacturer, in order to obtain the desired combination of load and compression, may vary the size of wire used, provided the fiber stress figured from the size substituted be not more than 10 per cent. greater than the stress figured from the size specified on the drawing. The following formula is used:

$$S = \frac{PD}{0.3927\ d^3}$$

where

S = The fiber stress,

P = The load in pounds,

D = Mean diameter of the spring in inches.

Purchasing under strict specifications, however, merely enables the buyer to reject defective springs or any shipment containing such, and does not prevent the supplier from sending in poor material, or obviate the delay and inconvenience attending its rejection.

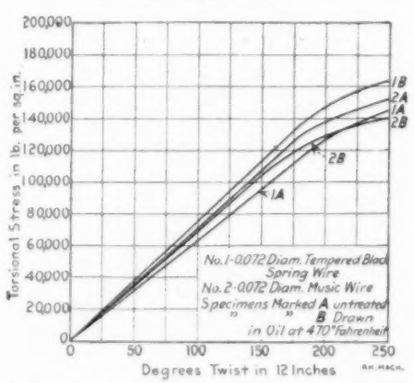


Chart 1. Torsion Test on Black Spring Wire

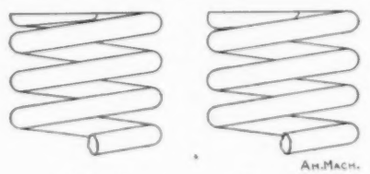


Fig. 1 Fig. 2

Good and Poor End Wire Construction

Why Some Springs Are Inferior

The causes responsible for poor springs, supposing the calculations to be accurately performed, may be discussed under two heads: 1. Imperfect workmanship, which may be remedied by somewhat greater care on the part of the workman. 2. Inaccurate knowledge of the physical properties of the material.

The first of these is responsible for the greater number of poor springs, and in the majority of cases the faults seem so slight that it is often difficult to convince the manufacturer that they are the cause of the discrepancies.

It will be found that of springs which are accurately designed those give most trouble which have the smallest number of turns or the smallest diameter in proportion to the size of the wire. This is because the source of most of the inaccuracy is in the two end turns which are "set up" against the adjacent turns and ground or hammered flat to fit the spring seat.

The end of the wire in the "set up" end turn should no more than touch the next turn as shown in Fig. 1, and not lap against it as in Fig. 2. In a large proportion of the springs tested the end turns lap as in Fig. 2, often to the extent of ¼ to ⅜ of a turn at each end. This robs the spring of ½ to ¾ of an active turn, this increasing both the compression per turn and the corresponding load at the required compression.

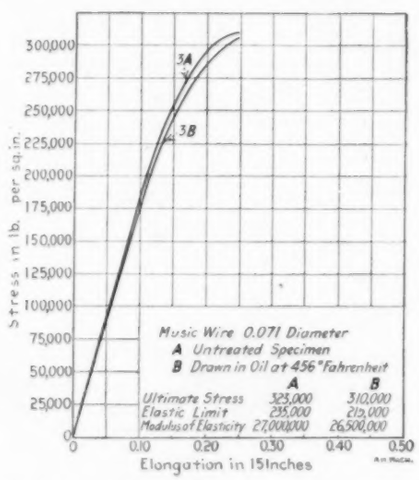


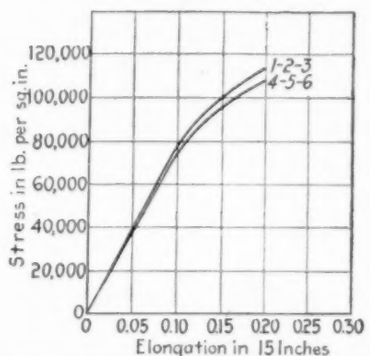
Chart 3. Tension Test on Music Wire

It will easily be seen that this is a serious matter in a spring of say, four to six turns and is sufficient in itself to throw the spring outside the requirements even of a specification which permits a variation of 10 per cent. from the specified load. In the case of some large springs tested the load at a given compressed length was found to vary from 6000 to

14,000 lb. The load required was 9000 lb. These springs were from $\frac{1}{8}$ in. diameter bar and had only 3½ turns. In some of them the end turns did not touch the adjacent turn at the tip. These were the low ones. In others the end turns lapped nearly a half turn.

One other case may be mentioned; that of a spring of six turns, $2\frac{1}{8}$ in. outside diameter, made from $\frac{5}{16}$-in. diameter bar. This spring should have given a load of 2180 lb. at $\frac{7}{16}$ in. compression. The actual loads obtained on testing 800 of them in one shipment ranged from 1900 to 3150 lb. The defect was in the manner in which the end turn had been set up and was so pronounced in many cases that the inspector was able to tell by mere examination that the spring would be too strong.

Later shipments of this spring made up with greater care proved satisfactory. It may be mentioned in passing that many firms making springs are not equipped



No.	Diameter	Ultimate Unit Stress	Elastic Limit	Modulus of Elasticity
1	0.128	124,500	×78,000	11,700,000
2	0.128	120,100	86,000	11,700,000
3	0.128	123,200	86,000	11,700,000
4	0.204	121,200	80,000	11,300,000
5	0.204	123,000	80,000	11,300,000
6	0.204	126,000	80,000	11,300,000

×Curve No. 1 so nearly Co-incided with Nos 2 and 3 that the Mean of the Three is shown. This accounts for the Varying Elastic Limits.

Am. Mach.

CHART 4. TENSION TEST ON PHOSPHOR-BRONZE SPRING WIRE

for the proper testing of either the material or the finished springs. With a suitable equipment defects of this nature could be eliminated before the springs were shipped; the result would be a saving to both producer and consumer.

Small springs should not be dipped in a heavy Japan and allowed to dry with thick films of the protective coating between the turns. No test, of course, is possible in this case. If a thinner mixture is used a uniform thin coating can be applied which affords the desired protection without danger of clogging the turns.

By far the larger number of springs which fail to pass are too strong. Springs are seldom below the requirements. This was explained by one spring maker on the ground that springs are usually accepted by railway companies even when considerably over the specified loads. Since the work done for railway companies forms a large part of their business, the spring maker usually aims high. This is given for what it is worth; as a matter of fact, we have seen that the ordinary defects of manufacture are such as would increase the load at a given deflection.

SPRING MATERIAL

Referring to the physical properties of spring material, there seems to be very little reliable and definite information available. This scarcity of information is remarked by several contributors on the subject, among others by Roy A. French, who, several years ago, published the results of a series of tests made under his direction, and covering over 150 individual springs. These springs were made from round bars, ranging from ½ to $1\frac{5}{8}$ in. in diameter.

Complete data are given for each size tested, and the torsional stress and modulus of torsional elasticity calculated for each. The modulus of torsional elasticity ranges from 12,500,000 to 18,000,000, the average being taken at 14,500,000. This is higher than the values given by most handbooks, 12,000,000 and 12,500,000 being the most common figures. Furthermore, these tests refer more particularly to the large springs generally used in apparatus which either permits adjustment or requires no special refinement. With small springs, those made from wire $\frac{1}{16}$ to $\frac{5}{16}$ in. in diameter, the case is different. These are largely used in apparatus made with interchangeable parts where no fitting is allowable. If a spring is too strong or too weak, it can only be rejected.

Tests on steel spring wire, 0.071 and 0.072 in. in diameter, covering oil-tempered black spring and music wire, were made. Representative curves are given, showing the result of tension and torsion tests on these materials.

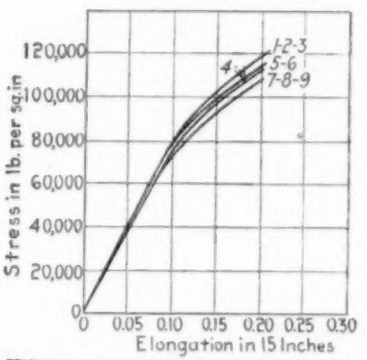
In determining the elastic limit from a stress curve, Prof. Johnson's method is usually followed. This gives a point on the curve somewhat above the point at which the first divergence from the straight line can be noticed. With materials which give a curve having a sharp "knee," this would be very nearly the true elastic limit, but where the material shows a well rounded curve, the elastic limit thus obtained may be several thousand pounds above the point at which the first divergence can be noted. This will appear in the tension curves on music wire accompanying this article.

In the case of spring materials which are often stressed nearly to the elastic limit, it would seem advisable to take as the elastic limit the lowest point on the curve at which any departure from the straight line can be noted. The elastic limit by Prof. Johnson's method is indicated on each curve by an arrow point.

The modulus of torsional elasticity, as taken from the torsion curves on music wire and tempered black spring wire, ranges from 12,400,000 to 14,600,000. It will easily be seen that if the engineer uses the figure usually given, 12,500,000, in his calculations, and the spring is then made up from material having an actual modulus of 14,000,000 or more, the spring will be about 15 per cent. too strong, even with perfect workmanship. This is one reason the manufacturer is allowed a certain amount of liberty in the size of wire to be usesd.

TORSION ELASTICITY OVER-RATED

In the absence of suitable testing facilities in most plants, the engineer must



No.	Diameter	Ultimate Unit Stress	Elastic Limit	Modulus of Elasticity
1	0.064	118,800	87,000	12,000,000
2	0.064	117,200	87,000	12,000,000
3	0.064	117,200	87,000	12,000,000
4	0.102	124,500	87,500	11,400,000
5	0.102	120,100	86,000	11,900,000
6	0.102	123,200	86,000	11,900,000
7	0.204	121,200	72,000	11,300,000
8	0.204	123,000	72,000	11,300,000
9	0.204	126,000	72,000	11,300,000

Am. Mach.

CHART 5. TENSION TEST ON BRASS SPRING WIRE

still guess at the modulus of torsional elasticity, but there seems to be small reason for the common error of overstressing the springs. The meager data available in handbooks encourage the designer to figure on working stresses of 80,000 to 120,000 lb. More account should be taken of the experience of firms who have used large numbers of springs for years and who have learned, to some extent, the limitations of this material when in fairly constant use.

It is the practice of one large, experienced consumer, to use no springs at a higher stress than 75,000 lb. per sq.in., and even this figure is reached only on springs made from wire under $\frac{1}{16}$ in. in diameter. With larger wire or bar, the stresses permitted range from 40,000 to 65,000 lb. per square inch.

The standard practice of another large firm is to allow only 40,000 lb. stress per square inch in designing springs. In a few exceptional cases it has used springs under stresses of 50,000 and 60,000 lb.

One point which has long been a bone of contention is the supposed superiority of music wire as a material for small springs. It is true that the breaking strength is much higher as a rule than that of tempered black spring wire; also the "relative elastic limit" as defined by Prof. Johnson in his "Materials of Construction" is generally higher, but this is due to the shape of the curve which bends at first almost imperceptibly, the rate of deformation gradually increasing and producing a long bend in the curve. In the case of tempered black spring wire the bend is sharper, covering a much smaller range of stresses.

Since the "relative elastic limit" is that point on the stress curve where the rate of deformation is 50 per cent. greater than at the origin, it will be seen that in the case of music wire this point falls much farther above the true elastic limit than it does in tempered black spring wire. If the first noticeable departure from the straight line is assumed to be the elastic limit the curves given with this article would show little to choose between the two materials, since both curves start to bend at about 200,000-lb. stress per square inch.

Additional curves showing the results of a number of tension tests on phosphor-bronze and spring brass wire, are given for comparison and the physical properties of each kind tabulated. The modulus of elasticity for the two materials is approximately the same, averaging 11,500,000 for phosphor-bronze and 11,700,000 for spring brass. Three sizes of brass and two of phosphor-bronze were tested, three tests being made on each size. The results were very uniform, the curves coinciding for all three tests in all but one set.

The modulus of elasticity obtained would indicate that for a given deflection a phosphor-bronze or brass spring would support about two-fifths as great a load as a steel spring the same size, assuming the modulus of elasticity of steel in tension to be 29,000,000.

The usual practice is to figure on half the strength of steel for phosphor-bronze or brass, and if we assume the torsional strength to be about in proportion to the strength in tension this seems somewhat high, although well within the elastic limits given here. The correct figure is perhaps between half and two fifths of the strength of steel.

When doing riveting and no rivet set is available, a cupped-point setscrew will make a very good substitute in most cases.

Cam Milling Fixtures for the Engine Lathe

By Harold E. Murphey

The illustrations show a fixture used in connection with a lathe for milling the groove in the style of cams shown.

This fixture consists of a cast-iron gear bracket and is attached to the lathe carriage by a hexagon-head bolt, as shown in the front view of Fig. 1. The top view, Fig. 2, shows the construction more in detail. The gear bracket carries the four sleeves *A*, which hold the end mills *B*. On the opposite end of the sleeves are carried the gears *C*, which turn the sleeves. These gears are run through a worm, worm gear and an intermediate gear, from a shaft connected to the large gear on the cone of the lathe.

The gear *D* is keyed to the driving shaft, the key being tight in the gear and a sliding fit in the shaft, which allows the shaft to travel back and forth as the carriage is moved by the master cam *E*. Allowance is also made for the movement of the carriage in or out, to feed the mills to the work, by a universal joint on the driving shaft in the position shown by *X*. In operation the carriage is, of course, left free to move on the shears of the lathe.

A dog is used on the arbor the same as usual, except when first milling the depth of the groove, when the dog is slipped out of the faceplate. The cams to be formed are keyed to the mandrel on which they are machined, and very satisfactory work is done at one cut, though, of course, for very accurate work two-sized mills must be used so as to give a roughing and a finishing cut.

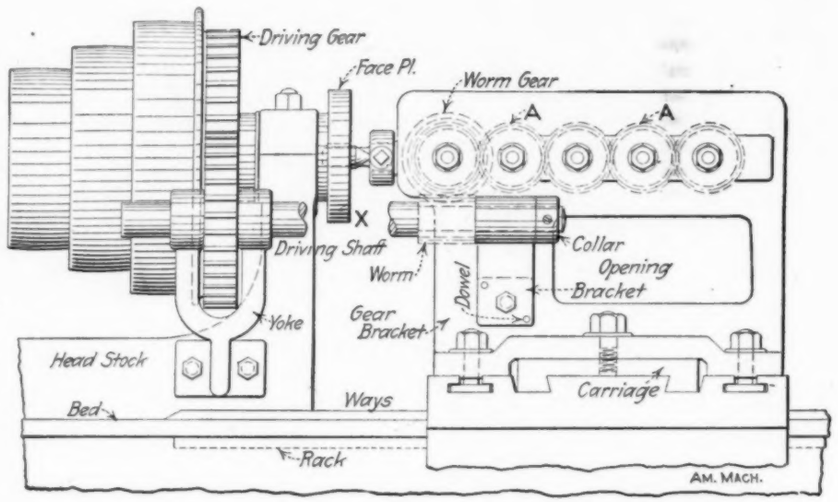


Fig. 1. Front View of Cam-milling Fixture

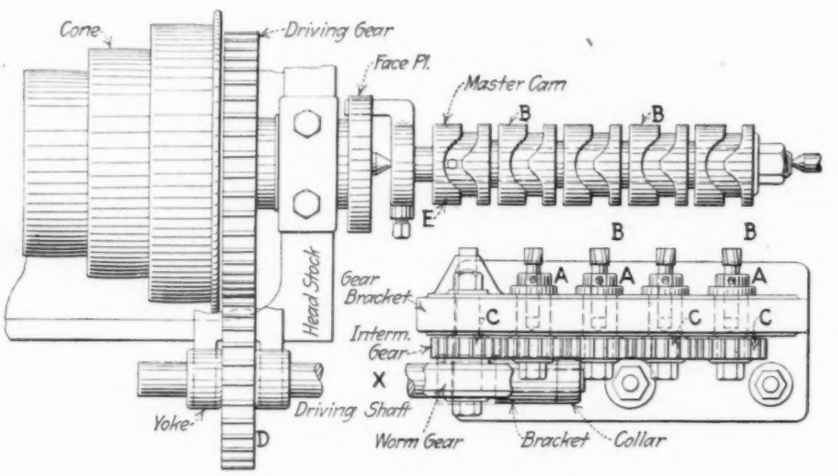


Fig. 2. Cam-milling Fixture, View from Top of Machine

During 1909 there were employed in the manufacture of agricultural implements 50,550 wage earners, according to a bulletin just issued by the Census Bureau. This showed an increase of 8.5 per cent. over the number employed during 1899.

Handling Repairs Systematically

By C. A. Tupper

Inadequate attention to repair work and its influence on the business of machine builders. An instance in which a manufacturer diverted into his own shop much of a competitor's business simply by organized attention to the repair of the machinery manufactured by the latter.

The system in a shop where repair work has been profitably and successfully combined with jobbing orders.

The basis of all permanent business is the satisfied customer. One of the most important factors in keeping the customer in that frame of mind is proper attention to the matter of repairs. Yet this is a phase of manufacturing which, during the hurry and rush of modern business, has been more neglected by machinery builders than probably any other than can be named. Repairs due to breakages which have to be made good at the manufacturer's expense, in accordance with his guarantees, are not being considered here, but rather the replacements rendered necessary by the wear and tear of continuous or intermittent operation, such as must be expected in the ordinary course of operation.

When there is a lack of new business, repair orders are usually sought, but when the facilities of a machinery-building plant are crowded with work, they are not welcomed and possibly evaded. Such evasion, or inadequate attention to the repair orders received, will, however, have a bad effect on the continued success of the machinery-builder's business. On the other hand, repair part orders ought not to be allowed to hold back or otherwise hamper the production of new machinery.

The obvious solution of the problems involved has been editorially suggested in the AMERICAN MACHINIST, viz: Separate provision for repair work and the devotion to it, of certain specified facilities; or, in other words, creating a distinct department for this purpose and putting it on a proper earning basis, the same as any other part of the establishment. There are, however, many different methods of working out the details, and the following observations are offered, merely for their suggestive value.

A System Applicable to Repair Work

In one large plant of the central West, comprising a foundry and machine shops, where jobbing or custom work forms a part of the business, the repair orders have been combined with such work and are treated on precisely the same basis. For the most part the methods employed might be adapted to a separate repair-part department.

As the orders come in from customers they are written out at the office in quadruplicate; i.e., three carbon copies. Two copies go to the shipping department, one being kept on file there and the other returned to the office when the part called for has been completed and shipped. The third copy is sent to the shop superintendent and the fourth is kept in an alphabetical file at the main office. From the order sent to the shop superintendent a requisition is made on the repairs department, and the order itself is filed alphabetically under the customer's name.

A clerk in the repairs department, which is here a part of the superintendent's office, then checks the requisition against the stock list, to ascertain whether the part is one regularly carried. If so, the requisition, after entry of the essential details on a card record, is sent directly to the stock clerk and forwarded with the part to the shipping rooms. From there it goes back to the repair department with a notation that the part has been forwarded to the customer by freight or express, as the case may be, with the route and date also stated.

These facts are entered on the card record and the requisition is returned to the stock clerk to be filed. In the latter's office there is a cross-reference between this requisition and the record of the particular stock from which it was withdrawn, so that it can subsequently be looked up, if necessary, from either side.

Meanwhile the second copy of the original order referred to has been sent from the shipping rooms to the billing clerk, with the particulars of shipment including prepayment of handling and carriage charges, if prepaid, and a statement of the total charge sent to the customer. Notice of shipment, with bill of lading or other necessary papers, is also mailed to the customer on the same day that the part is forwarded. In writing out shipping directions, no abbreviations are allowed, even the name of the state being written in full, since the company had trouble over a shipment billed to "Ia.," which turned up in "La."

If the part is not carried in stock, but must be cast and machined, a requisition from the repair department is sent to the office of the pattern shop and foundry. When a new pattern has to be made, an order for it is entered accordingly, but if not, the requisition is sent directly to the pattern-storage foreman, the pattern found and sent with a molder's ticket to the foundry; the requisition being returned with a copy of the molder's ticket to the pattern shop and foundry office. There the requisition is filed alphabetically and the copy of the molder's ticket numerically, with cross-references.

Rush work is indicated by a pink ticket. All work done on repair jobs is checked up at night, and a record kept in the pattern shop and foundry office, which shows at any given time, by the cross-references, how far any order has progressed toward completion. When the casting is delivered to the machining department, it is kept track of in a similar manner and the course of the finished part, with the entry of records, etc., is precisely the same as described for one taken from stock, except that production costs also go to the billing office.

In the pattern shop and foundry a separate set of records is kept for repair work, under the supervision of a clerk especially assigned to that service, but none of the equipment is set aside for it. Ordinarily the parts go through on regular orders, which are made large enough to include both current manufacturing needs and stocks from which repair parts can be drawn. The same is also true, in general, of the machine shops; but there certain tools of each group are assigned to the repair department and, if needed in repair work, they cannot be used for any other. When not so used, they are at the disposal of the other departments on the basis of a suitable credit to the repairs department.

This is only approximated, in order to avoid unnecessary clerical work. If more facilities are needed than these tools afford the repairs department "buys" service from other departments, and if need be can get help outside. The equipment placed at its disposal, however, is sufficiently liberal to provide for all ordinary contingencies. Naturally, when work is slack some of the repair tools stand idle, as the manufacturing and jobbing departments give preference to their own machines; but, as a rule, the balance is well maintained. If any department, however, can afford standby losses, it is the one controlling repairs.

It is desirable for any machinery manufacturer, as has been done in the case cited, to handle the repair work as a separate department and have someone of sufficient ability made responsible for its success. It cannot only be made a means of maintaining satisfactory relations with customers, but also of earning an excellent dividend on the permanent investment and working capital which it involves.

Compared with the percentage of profit on new machinery, spare parts and re-

pairs almost always bring good prices; and as most of them come in without solicitation there is no selling expense attached to them; this still further increases the relative net returns. The principal danger here is to avoid the temptation of charging too much to customers, particularly where advantage can be taken of their pressing necessities, and thereby alienating them from future patronage when purchasing new equipment.

Repair Work Should Be Solicited

While repair orders will come in unsolicited, no manufacturer of machinery should sit back and wait for them to be forced upon him. He should at least make customers understand that this work is wanted; that he wants to make all the repairs on the machines of his build and that they will be given just as careful attention as orders for new equipment and with as prompt shipment as possible.

Without making any effort to remember others, three machinery-building companies can be mentioned that have been heavy losers as a result of indifference to this policy. The apparatus manufactured by each is of standard design, approximated very closely by competitors, and the latter are in a position to fill orders for repairs without much difficulty.

One of these concerns has out nearly 30,000 machines, which are subjected to peculiarly severe service and, under the most favorable conditions, require frequent renewals. Some years ago its nearest competitor, whose apparatus is practically interchangeable with the other in the wearing parts, made this feature even more pronounced by changes in design and started out to get the first-named company's repair orders. This it had no trouble in doing, as users were tired of the inattention given to that phase of the business, and soon the competitor had practically the control of the repair work, which it clinched by making very favorable terms for season contracts.

It did not stop there. Gradually, as new machines were needed, the competitor, being in constant touch with users, got its own taken on trial and, using the repairs brought to it as illustrations of the weak points of the original make, displaced the latter more and more. Many times the company which had been first in the field and had practically developed it, did not learn of these opportunities for new sales until long after the competitor had made deliveries. Today, the relative positions of the two are reversed. The other two cases are similar, but have not been carried to the same extreme.

One of the advantages enjoyed by the concerns that made a specialty of repairing the machines of competitors, as well as their own, was the experience obtained from the continual handling of the various parts and the knowledge thus forced upon them of the effects of actual service conditions over a wide field of operation. It enabled them to make such a study of the essential factors of design as to put them in the lead of other manufacturers of the same types of machinery.

This applies with practically equal force to work done by a manufacturer and involving repairs to machines of his own build exclusively. There is no better means of becoming acquainted with points of weakness in their mechanical structure, and with desirable alterations either in design or in the selection of material.

Furthermore, if this department of the business is properly conducted, it will enable average production costs to be cut down by the ability to put certain interchangeable parts through the foundry and machine or forge shops in greater quantities and to handle stock to better advantage. The points covered by this phase of the subject have been so much discussed that there is no need to elaborate upon them here.

Interpretation of Customer's Orders

With respect to the interpretation of customers' orders there has been much confusion and misunderstanding. On the user's part, if any doubt exists as to what will be meant, a rough sketch of the part wanted should be forwarded with the type and size of the machine, date purchased and shop number if given.

The manufacturer, on the other hand, should not allow any guesswork at his end, but should be reasonably certain before an order is entered that it is thoroughly understood. It will, moreover, well repay him to place in the hands of every customer a repair-part list, with outlines of the machine or machines having each part indicated and numbered. This will go far to obviate mistakes. In issuing such lists care should be taken that, once a part is numbered, the number is not changed in future publications.

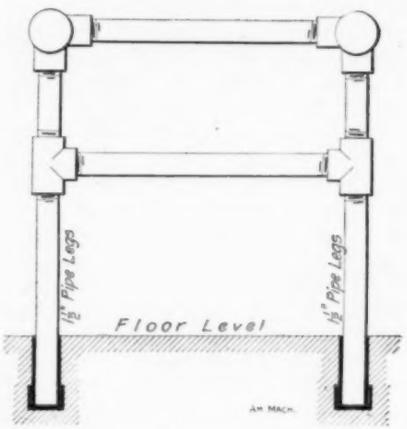
For repair lists it is desirable to have opposite each part a code word to be used in telegraphing or cabling, and also a list of phrases customarily used in ordering, with a code word for each. The least liability to confusion, where no secrecy is involved, is secured by taking cipher words, with the permission of the publishers, from one of the commercial codes in extensive use, such as the Western Union.

The matter of handling repair work has not been given anything like the attention it deserves. Manufacturers abroad, particularly in Germany, give every whit as much consideration to this part of their business as to any other, and this has unquestionably been an important factor in the tremendous development which has recently taken place there, in every line of metal working.

A Removable Guard Rail

By F. D. Buffum

The cut shows a handy type of pipe guard rail setting where concrete or masonry floors are used or where enough concrete can be placed to insure solidity. It is particularly available around engines, compressors, etc., that sometimes require barring over to start, because it can be quickly lifted out of the way.



A Removable Guard Rail

It is made of 2-in. pipe for sockets of uniform length, with standard pipe caps on the ends. The length of the sockets will vary according to conditions. They are set permanently in the floor or foundation. Instead of a combination of 1½- and 2-in. pipe, which go together freely, 1- and 1¼-in. or other combinations can be used. This gives a stronger and cheaper construction than bolted or screwed flanges and has the advantage of being instantly removable.

The action of the directors of the Metropolitan Museum of Art, New York, may be of interest to shop owners who feel that their plants are fireproof. The fire hazard in this case is slight because the building itself is about as nearly fireproof as it could well be made. Not only this, but much of the contents is also non-inflammable. In order, however, to complete the safeguarding of such of the treasures as would be liable to destruction or serious damage in case of fire, they have decided to install automatic sprinklers in the basement—the place where fires in such structures are most liable to start. The management of the museum is apparently unwilling to take the chance which was taken by the State of New York in the magnificent capitol building in Albany, in which unreplaceable records were destroyed.

Special Tools in the 'Frisco Shops

By F. A. Stanley

A substantial attachment for enabling links, quadrants and other work to be machined to the desired radius on the slotter. Planing cross heads; machining metal packing; grinding-in rings.

Eccentric drilling and tapping jig; gage testing apparatus; air-room appliances for handling pumps.

A toolroom cabinet and some machine attachments.

One of the many interesting tools at the Frisco shops, at Springfield, Mo., is a slotter attachment, shown in Fig. 1, for machining links, quadrants, etc., to the desired radius.

This is a substantial device applied to a Betts slotter by bolting a supporting bracket to the front of the slotter base for carrying the main bar *A* of the attachment. Upon this bar is mounted a bracket *B*, at the top of which the radius arm *C* is pivoted. This bracket is adjusted by a screw to the required position, and the radius arm *C* is then clamped by a split nut *D*, which is tapped into the swiveling member *E*. Bar *C* is attached to the slotter table by bolting it to a cross-slide, the base of which is in turn bolted to the table. This forms a convenient means of getting the work to the cut.

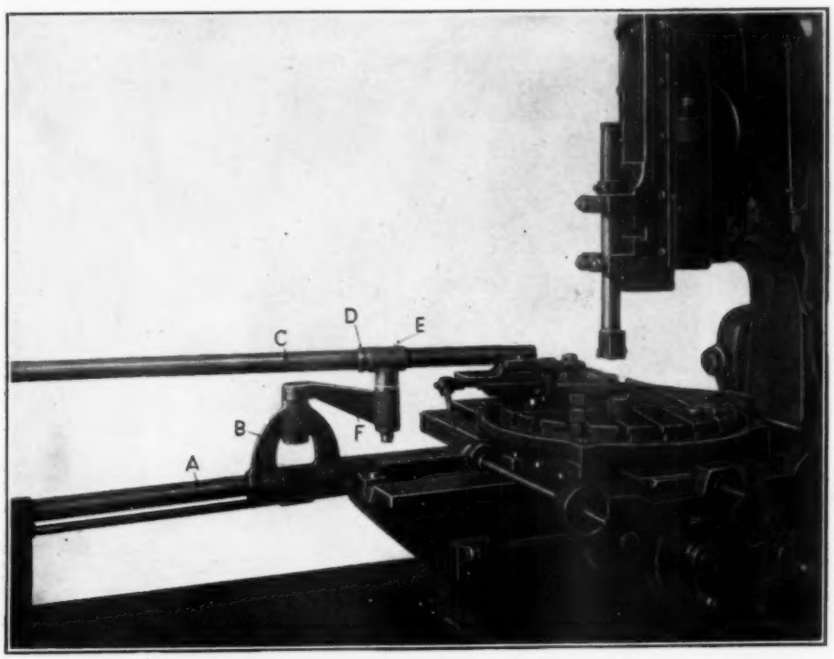


FIG. 1. RADIUS ATTACHMENT FOR MACHINING LINKS, QUADRANTS, ETC., ON THE SLOTTER

The attachment is shown set up with a short extension arm at *F*, which enables work of short radius to be machined without interference between the bracket *B* and the front of the slotter. For work of greater radius, the extension is dispensed with and the pivotal member *E* is carried directly in the top of the bracket *B*.

CROSSHEAD PLANER FIXTURES

A method of holding crossheads while planing is shown in Fig. 2. The V-blocks in which the work is carried are of ample height to suit various sizes of crossheads; they are provided with swinging straps open at one end, to swing clear of the pivoted bolts at the front when released by a turn of the nut, so that it is a simple matter to set the work in place and remove it when planed.

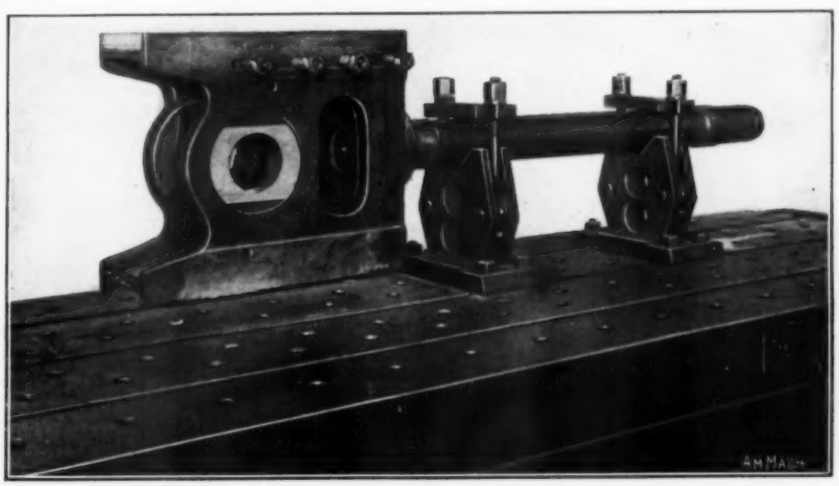


FIG. 2. PLANER FIXTURES FOR CROSSHEADS

It is the practice at this shop to handle the various classes of work by departments, thus the rod work is done in one section of the shop equipped with its own tools, the pistons and crossheads in another section, and so on. This makes it unnecessary to carry the work around the shop from, say, the lathe department to the planer department, to the slotters, etc.

PACKING TOOLS

Two views in the piston and crosshead department are presented in Figs. 3 and 4, the first showing a Schumacher & Boye lathe, with chucks for holding the piston-rod and valve-stem packing for boring, and the latter illustrating a bench machine for holding all sizes of joint rings for grinding.

Referring to the lathe operations, it is customary in this shop to handle split packing with chucks, which hold the halves together without soldering. Such chucks will be seen upon the lathe in Fig. 3. For boring, the halves are placed in the chuck members *A*, which are provided with conical interiors to press the two parts of the packing ring together and hold them central.

The chuck members are formed with interrupted threads, so that a quarter turn suffices to close them tight upon the work. One of the chuck rings is adapted to be attached to the spindle nose and the other has an opening of ample size to admit a boring tool for boring out the work.

The exterior of the work is machined by mounting it upon an arbor of the type shown at *B*, Fig. 3, where the two halves of the packing rings are held together by the internal conical seats formed in the clamping collars.

The bench head, Fig. 4, for grinding all sizes of joint rings carries a series of adapters or split chucking rings, which fit the interior of the different sizes of joint rings. Abrasive material is fed to the revolving ring, and the outer member of the joint is held against the ring by hand until a close joint is ground.

Drilling and Tapping Eccentrics

A jig under a Cincinnati-Bickford radial driller, for drilling and tapping operations on eccentrics, is shown in Fig. 5.

The jig proper is mounted on the sides of an angle plate and adapted to swivel in the vertical plane. The work, whether eccentric block or strap, is secured to the under face of the jig, and both members are drilled through the same bushings, with the jig set horizontally. For drilling and tapping the holes for setscrews, the jig and work are tilted to the desired angle, as represented in the engraving.

Testing Apparatus

Some of the testing apparatus for cages and air equipment is shown in Figs. 6 and 7. The testing department is located in the gallery along the side of the shop and contains much important apparatus.

Fig. 6 illustrates a bench equipped with test gages for vacuum, air and steam gages, and with facilities for testing air apparatus. Fig. 7 shows two convenient types of stands used in the air department for overhauling and testing air pumps. The method of holding the work and the means of adjusting are obvious from an inspection of the halftones.

Toolroom Features

The toolroom in the gallery has a number of interesting features, one of which, Fig. 8, is a cabinet for holding plain and formed milling cutters, taps and dies, and

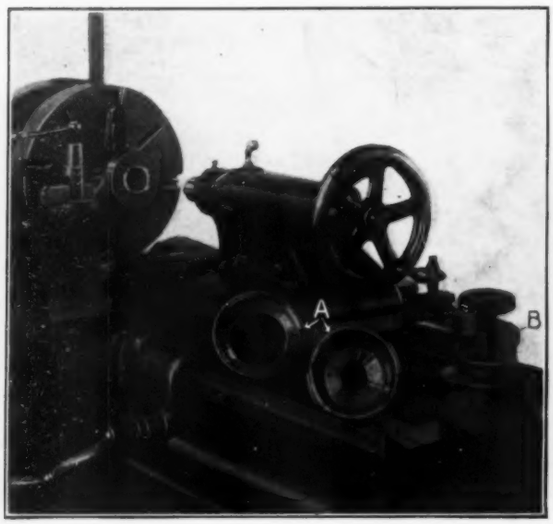


Fig. 3. Lathe Chucks for Boring Packing

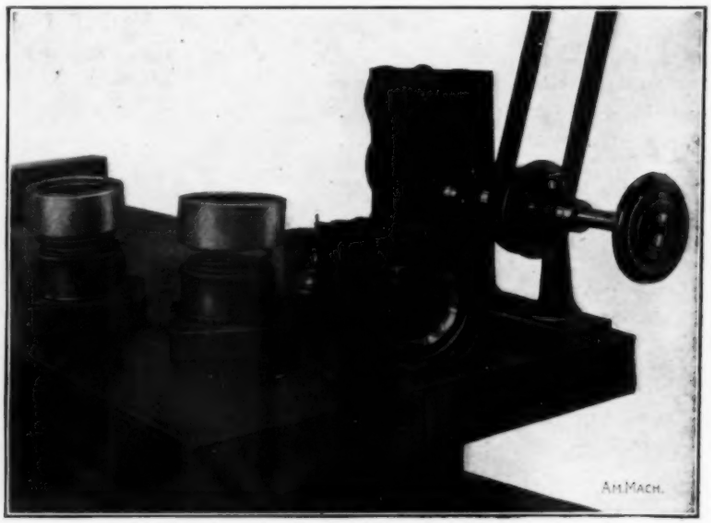


Fig. 4. Machine for Grinding in Rings

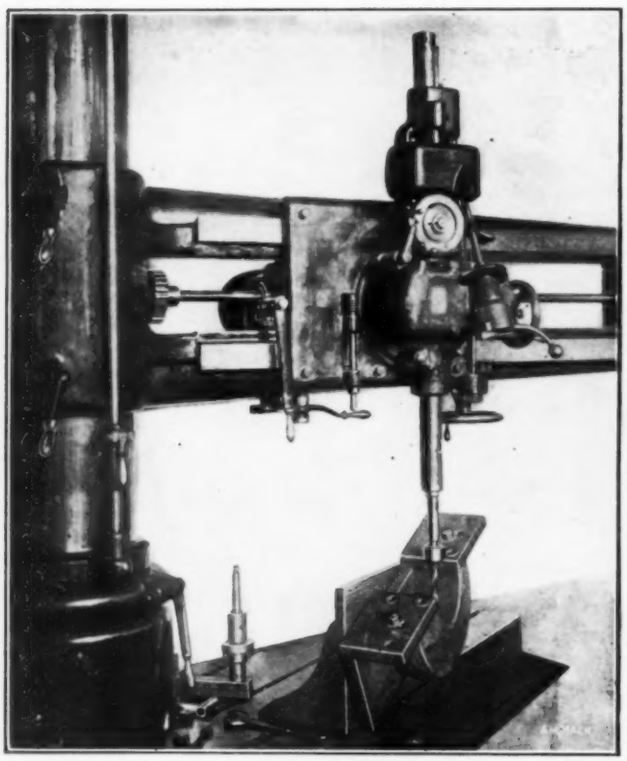


Fig. 5. Jig for Drilling and Tapping

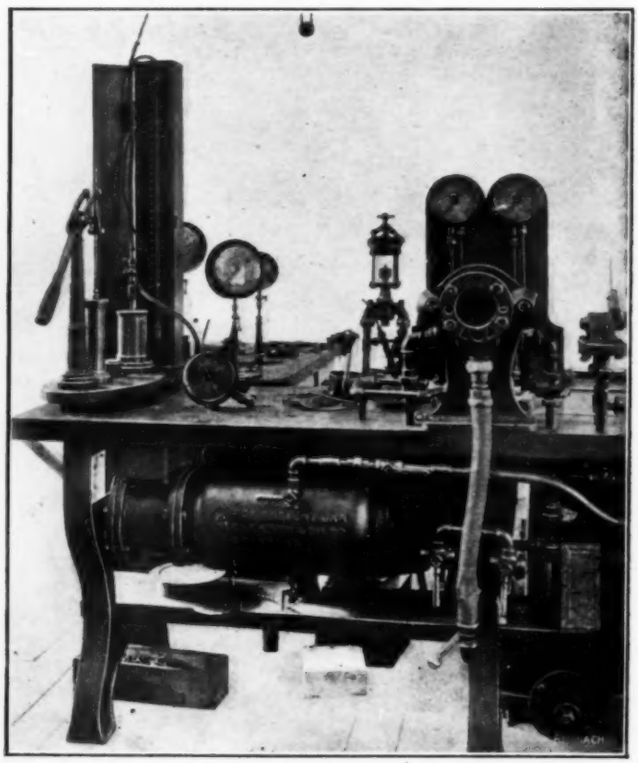


Fig. 6. Bench and Test Gages

other tools of the kind. An inspection of this cabinet reveals the fact that a thoroughly modern equipment of cutters, master hobs, reamers, etc., is kept on hand in excellent condition. The cabinet is made of metal and the lower part is used as a storage for finished tool stock and milling-machine attachments.

Lathe Equipment for Stay-bolt Taps

The Pratt & Whitney tool makers' lathe, in Fig. 9, is shown fitted with a geometric die head for threading stay-bolt taps. The attachment by which the die head is mounted upon the lathe carriage is shown clearly. A number of tap blocks are seen on the stand at the rear of the lathe; the backing-off attachment and an extra die head for larger sizes of taps are also included in the view.

Fluting Attachment for the Miller

The miller attachment in Fig. 10 holds three stay-bolt taps for the fluting operation, which is accomplished by three form cutters on the arbor. The taps are dogged at the upper end to rotate with the three spindles in the fixture and suitable means are incorporated at that end of the fixture for indexing the work properly. The centers in the tail block are actuated by knurled-head screws. These are plainly seen in the illustration and have been found handy.

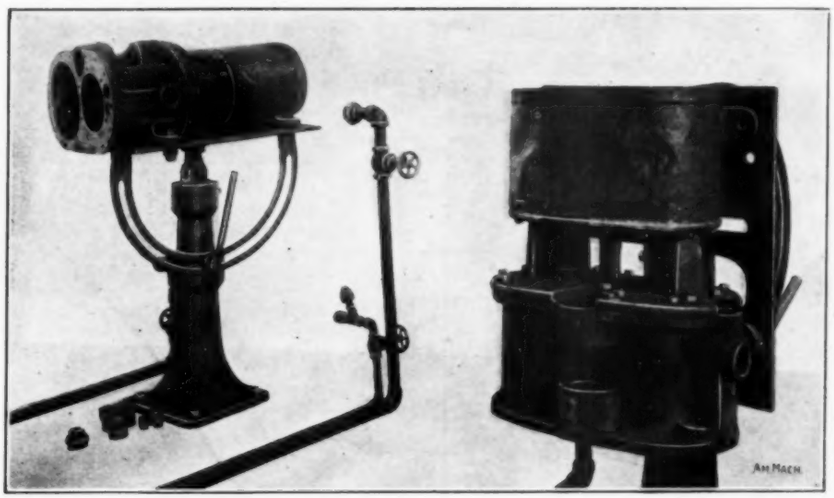


Fig. 7. Adjustable Stands for Overhauling Air Pumps

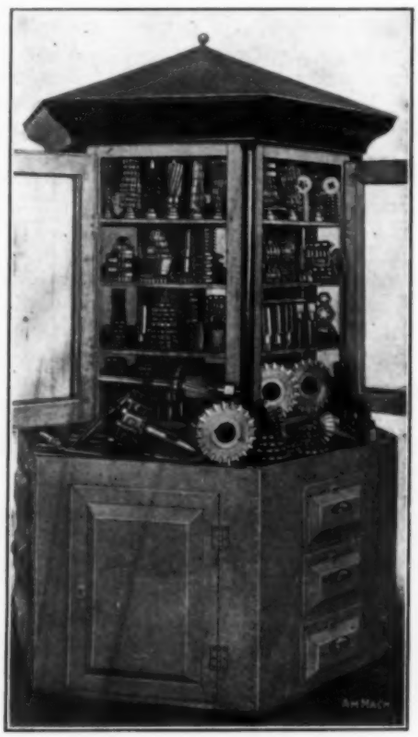


Fig. 8. Metal Cabinet in Tool Room

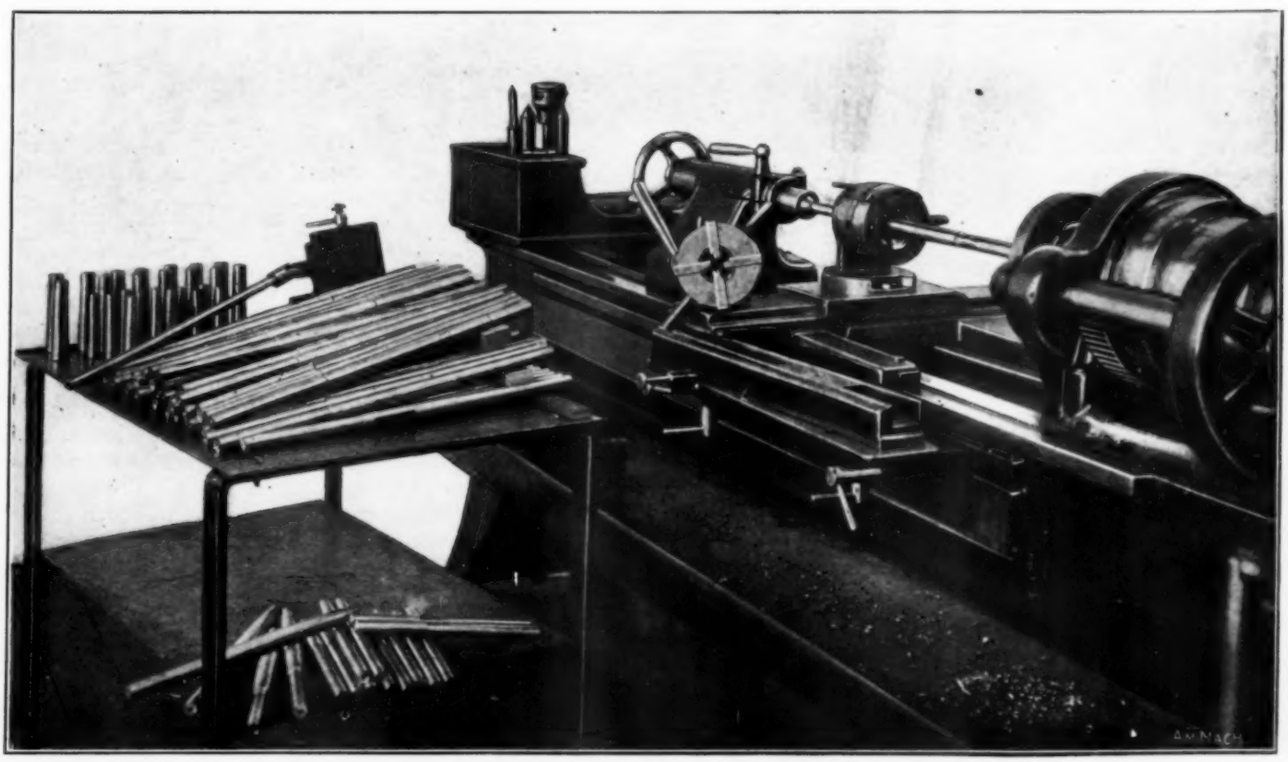


Fig. 9. Lathe with Tool Head for Threading Stay-bolt Taps

First Principles in Shop Instruction

By L. J. Rogers

Some time ago I pointed out through your columns the low efficiency of shop teaching in schools, and the great lack of a definite, clean-cut purpose in such teaching. There was plenty of evidence that these conditions had been keenly felt by manufacturers and others especially interested in industrial education.

Much has been written and many expensive experiments made along these lines in the last eight or ten years. If, then, your editorial in Vol. 35, page 1091, can be called an accurate and careful summary of the movement, it is indeed a subject of sad contemplation for all real lovers of this type of instruction. That your recent words on industrial education are all too true, its most ardent supporter, if he has good opportunities to observe, must concede. But it is confidently believed that many of the most evident failures are merely temporary.

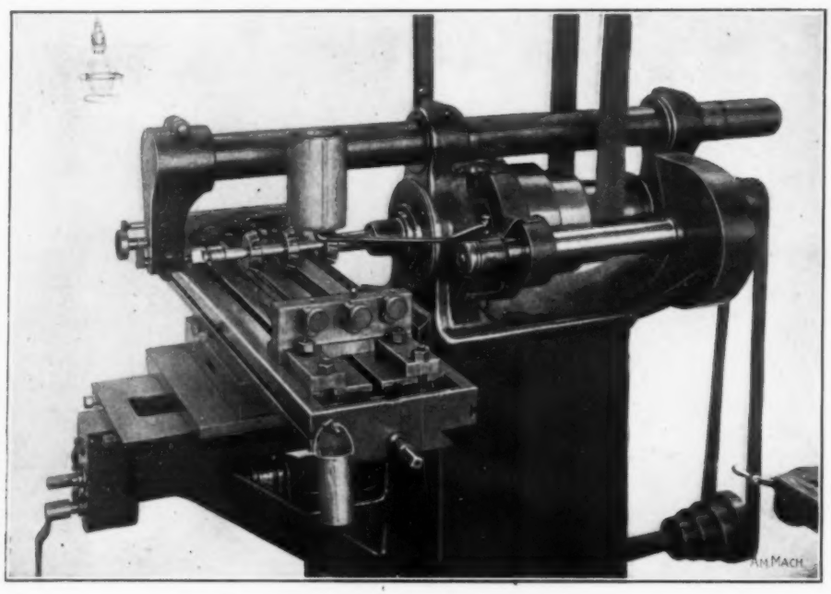


Fig. 10. Triple Fluting Attachment for the Miller

Before attempting to place the responsibility for these shortcomings, it is well to recognize the fact that great harm has been done the cause by friend and foe alike by such proclamations as: "If John is no good in book learning and is not wanted by the storekeeper or manufacturer, send him to the industrial school." No matter how well the school shop may be, it is no panacea for all the ills of the educational world. Careful, painstaking, persistent work—real thought and real industry, are even more necessary in this type of school than in any other.

Difficulty in the Managing Board

In regard to the managing board, the difficulty is well summed up in the editorial comment: "The manufacturers have not been given, or have not assumed control in directing these schools." This is undoubtedly the first and greatest lack in industrial education, and to this fact can be traced many of its existing weaknesses. I do not profess to know why the men who "knew the needs, and were the ones most vitally interested because the ones to be helped" have not taken their places on these boards, but venture the opinion that in some cities at least the manufacturer, most practical of men, is not wanted by school men and their coterie.

This difficulty is minimized when a set of men, none of whom has any grasp upon the trying problem of trade instruction, employs as director a man thoroughly versed in such work, delegating to him a great deal of power. When, however, such boards select as leaders men who could in no case make efficient workers or leaders in the industries, the result can easily be imagined.

As to the principal himself, academic attainments alone, no matter how great or brilliant, cannot fit him to see life from the standpoint of the boy who must learn a trade or start life upon the dreary road of the common laborer.

However, it is to the door of the shop teacher that we can trace a great many of of the worst failures of the system. Without his often foolish promises, no boy would get the notion that because of school training he can enter a shop as foreman or superintendent.

Where Shop Teachers Fail

The manager of a splendid factory employing some 2000 men was asked: "Wherein do we shop teachers fail?" His reply deserves the most careful study of leaders as well as teachers, in industrial education: "You take boys, in evening classes for example, and let them dabble a little at the lathe, planer and universal miller. In a few months they think they are machinists and won't believe us when we tell them they don't know how to run a drilling machine. You spoil our boys."

Some Fundamental Principles of the Machinist's Trade

What then are the fundamental principles of the machine trade which an ambitious apprentice should try to get first of all? Or, put differently, what should shop instructors try to instill in their boys as a good foundation upon which to build a first-class mechanic?

One should teach the great importance of a small speck of dirt in the spindle bearing of a lathe, miller or drilling machine. The student should have drilled into him the vast importance of the one overlooked oil hole, the neglect of which may cause a breakdown. He should be taught to handle and care for fine tools. Prompt, faithful obedience should be exacted from the boy at all times. He must be shown how to do some modern work according to the best methods and on the best tools. Last of all, and of great importance, we must try to inspire the boy with the desire to know.

To some it will undoubtly seem that little things have been over emphasized in the above, but the mechanic will recognize at once that I have placed first things first. The careful man knows that the boy well started on the simple things will rapidly take on the rest, and it is patent to all that the boy who is taught freak problems or special jobs is soon entirely too good to be careful in such a job as cleaning a machine.

The School Shop Can Be a Success

I confidently believed that with some vital changes in the means and methods of shop instruction, the school shop can teach a trade more quickly and better than any apprenticeship system can possibly do. Let the skeptical investigate the records of some good trade school, one which has a definite purpose and a determination to fulfill that purpose.

As for the modern apprenticeship system, this method undoubtedly puts the full control in the hands of men who know what they want; but it must not be forgotten that shop managers are more vitally interested in this year's dividends than in hoped-for benefits some years in the future. Then, too, any broad system is necessarily expensive, and the results are just as apt to go to one's competitor as to remain with the company.

Industrial education is first of all the big problems of the state or community. It is primarily a benefit to the state and the state should stand the expense.

Standardization of Machine Tools

By E. H. Fish*

Some further considerations involved in the general subject of standardization from both the maker's and users viewpoints.

*Manager, Worcester Trade School.

While an argument should have no greater value than the facts back of it, it may be interesting to discuss the question of standardization from the point of view of the manufacturer of such machinery, that being tempered by a more recent experience as a user.

Manufacturers are in business for profit, therefore no appeal made to them for standardization, which does not show a possible profit, is likely to receive consideration. On the other hand purchasers of machine tools are in business for profit also. If they buy a standardized machine tool more readily, or at a higher price than a nonstandardized tool, then we have the first requisite for convincing the machine-tool builders.

As users, should we pay more for a standardized machine, or should we make it any less expensive for a builder to sell such a machine? This it appears is the real question to be discussed first of all. Suppose now that some builder has brought to our attention a machine for which we are in the market, and says "We guarantee this machine to be fully up to the X Y Z Association's standard." Supposing that we had never had any connection with the machine-tool industry, would it not be almost certain that we would feel that the guarantee meant more than any other that we can get?

If we ask any builder or dealer for a guarantee today what do we get? Practically nothing except that the maker guarantees that the machine suits him. If it does not suit us we can usually return it, and pocket the loss due to setting up and getting ready to use it, which means that almost always we will accept the machine and pay for it even though it does not prove to be what we expected.

The great bugbear of the salesman and the treasurer is the sales that won't stay sold. The larger part of these sales is made by what the customer falsely considers misrepresentation; that is, pure cases of misunderstanding on the part of one or both parties. When a salesman comes in and tells me that his planer is the best ever and offers to prove it, how does he go about it? He usually tells me who has one like it and how well he likes it. I never write and inquire because I am pretty sure that that particular customer was not one of those who had trouble. Or he may tell me that it is built of the best materials and all slides are scraped to surface plates, all shafts are ground, etc. Yet that planer may give me 57 varieties of trouble just because those same ground fits are too well, or tightly, fitted.

The average purchaser knows no more about a machine after he has seen it than he did before. The man who comes into a builder's shop to see a lathe, looks it over for general symmetry of design, just as he would look at a steam yacht or an aëroplane. Then he takes hold of the crossfeed crank and feels the backlash and does the same to the tail spindle and the compound rest. He tries the apron handwheel in the same way and listens to what you have to say. Out of a thousand men who come into a machine-tool shop to look over machinery, not over 10 do any more, and the shop foremen that are sent out by their firms to look into new machinery usually do less. They know that a machine tool cannot be really inspected without largely disassembling it.

When a new machine reaches it destination and the bearings begin to seize, and alignments are found unsatisfactory, who can decide whether they *were* right or wrong? The maker can truthfully say that the work was all done according to his standards, and the user can also say that his idea of standards is something else. One trouble may be that the workmanship is too fine and there is not room for oil in the bearings. The machine may be built to satisfy 90 per cent. of the maker's customers and be totally unfit for 5 per cent.

Eliminating Competitors on Repeat Orders

Again a customer who has a shop of any size at all often buys a second or a third lathe of the same make as the first, just for the sake of getting a machine with the same size nose of spindle, or one on which he can use some fixture that he made for the first lathe. That is, competitors do not get the same show that they would if all makers agreed on certain definite dimensions that the customer is constantly dealing with.

Take tail spindles as one of the least necessary things to standardize. Suppose for example that it was decided to adopt certain sizes as standard, not for certain size lathes, but to be used as the designer may see fit. Let these sizes be 1⅜, 1⅞, 2⅜, 2⅞ in, etc. If the very occasional customer who does make a fixture fit on a tail spindle has made one to fit a 2⅜-in. spindle he can easily bush it to fit a smaller one. There has been allowed enough difference between sizes to make a substantial bushing. If when he made this fixture he had any thought of using it on a lathe larger still, he could have bored it to the standard size that he considered the limit in reason and used bushings on everything else.

It does not seem to me that any dimensions ought to be so standardized as to in any possible way interfere with the progress of design; in fact, no such standardization can ever be made, because standards will be adopted only as they prove to be worthy of adoption. If someone should very foolishly set a standard ratio of back gearing for a lathe or drilling machine it would probably never be much used because a different ratio would not interfere with the customer's use of the machine for the same purpose that he used another machine.

On the other hand a standard taper for lathe centers is needed by customers to a very considerable extent. The Morse taper is in just about enough general use to make us wonder why anyone refuses to come into the fold until we begin to look into the vagaries of the system. Then we wonder why anyone ever used it at all. Change gears, uniform as to width of face, diameter of hole and keyway, would be a talking point worth considering, in any shop where odd or fractional threads occur and a general roundup of lathes is made to find one where they can be cut.

A limiting standard for swing over ways and swing over carriage would be of value to the maker as well as the user, as limiting the tendency to apparently give more for a dollar than some other builder. Standard "hand' for adjusting screws would be a comparatively easy step, but one that would be a good talking point for the salesman. In fact the coöperation of the sales departments would be the first and simplest stage of introducing standardization.

The Question of Speeds

One thing which I believe has been proposed by the advocates of scientific management, and which it also seems to me should be looked at with some suspicion before being adopted, is the proposition that all lathes of the same swing should be speeded alike on all steps of the cone or other speed-changing device. While there certainly are arguments in favor of some one ratio between different adjacent speeds, there are also other arguments just as valid

for an infinite number of ratios. The ideal machine would have an infinitesimal difference of speed between steps, so that the exact cutting speed which the operator desired could be obtained.

All efforts to do this in the past have resulted rather doubtfully to say the least. It seems to be largely a question between the ideal and the pocketbook, like most of our other problems, in which the pocketbook is gradually allowing a closer approach to the ideal. Whether the ratio between adjacent speeds shall be 1:2 or 1:1.1 or something else depends on what the market will stand and also on our definite knowledge of the best cutting speeds and feeds. So long as men are of a number of minds as to whether machine steel should be turned at 50 or 80 ft. per minute we can get a speed which someone will believe correct if the ratio between the speeds is 1:1.6. If we ever decide that the proper cutting speed lies between 60 and 70 ft. per minute then we shall have to narrow the range to about 1:1.16 and so on, unless we compromise a trifle and say that we would as willingly run at a little slower than our exact best speed if we can crowd the feed a little. If we take this into consideration then it is simpler to build a machine with a large number of feed variations than with many speed changes, and our speed ratios will remain as they are now, rather large.

The only valid reason that there appears to be for wanting uniformity of speeds in lathe construction is in a matter of convenience to the planning department. If all lathe speeds were alike it would be possible to issue instruction sheets to the shop which would simply say, "Use the middle speed, without back gears" and every lathe of that size in the shop would be speeded right for that job.

Believing that actual figured speeds are much less desirable than speeds found by test on the particular job, it seems that we can well get along without this refinement. When it is so simple for a man to speed his lathe up one step faster and see how the tool is acting it is easy for him to run quite a bit faster on the larger part of his jobs than any planning department would dare to schedule, simply because they must set their speeds low enough to cover the occasional hard casting or the one that runs out so that a heavier chip is taken on one side than is expected.

Standardization An Asset to Salesmen

From this brief review it would appear that there are many places where standardization would make the work of the salesman lighter by adding "talking points." When we notice the avidity with which manufacturers add odds and ends of freak bits to their machines for the sake of getting a talking point which is purely mechanical it seems as though they would be equally anxious to add such points in other directions.

It is doubtful if there are many ways in which the manufacturer can reduce costs in his shop by standardization. On the other hand it is not at all necessary for him to increase those costs. No one who is alive is keeping the same design on the market very long. If any standards are agreed on it will then be ample time for the individual manufacturer to decide whether to follow them when he next redesigns the machine.

With the most progressive manufacturers it is almost certain that standards would be quickly followed; many others would, of course, trail along behind as they found the demand to impel them to do so. A few years ago there was a single, but infallible rule for determining whether a lathe was standard or not, and that was to measure the width of the inside V's. If the distance between the centers of the V's was half the swing of the lathe, then it was standard, otherwise not.

It will be necessary in this age to have standards for a number of dimensions other than that to determine the degree of standardization of any lathe, but that a fair standard will attract builders, through their customers, there can be little doubt.

An Improved Turret and Socket

By F. P. Strachan

Having under my charge several boring mills and a turret lathe I have for some time been on the alert to see if some maker of this class of machine with the turret tool post would produce one that would allow of the bars or sockets being withdrawn as easily as they can be inserted.

All turret tool posts are very much alike. Bars may very easily be inserted and very securely held while in place but the removal is generally left to the workman. This is especially troublesome in the case of drill sockets, in which it is necessary to have the drill shank within the turret, as the socket must first be removed before the drill can be changed or removed.

In Fig. 1 is shown my method of overcoming this difficulty. As will be seen the drift slots *C* have been added, and so far have proved a success. Not only can all bars be removed but, with the use of a Morse socket as shown at *A* the changing of Morse taper drills and bars can be accomplished at will without disturbing the socket, which remains securely gripped in the turret.

At Fig. 2 is shown a special Morse socket which I designed, but never made, owing to the success of the slots. I see no reason, however, why it should not work satisfactorily in cases where it is difficult to apply the usual drift for removing the drill. As will be seen *A* is a drill shank which is fitted to the sleeve *B* in the usual way. This sleeve telescopes into the socket *C*, and is held by a left-hand thread as shown. Pin *E* is riveted into plate *D*, which is dovetailed, or otherwise fixed to the socket *C*. A forward turn of the sleeve *B* brings the drill shank in contact with the pin *E*, and is forced out. The socket *C* can be made to suit the bore of the turret, care being taken to have the various parts concentric.

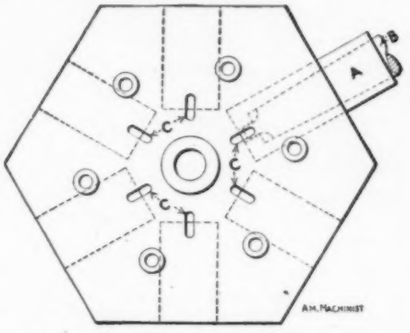


Fig. 1. The Socket in Position in Turret

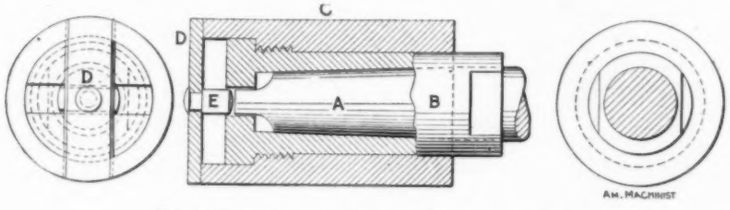


Fig. 2. Details of Socket Construction

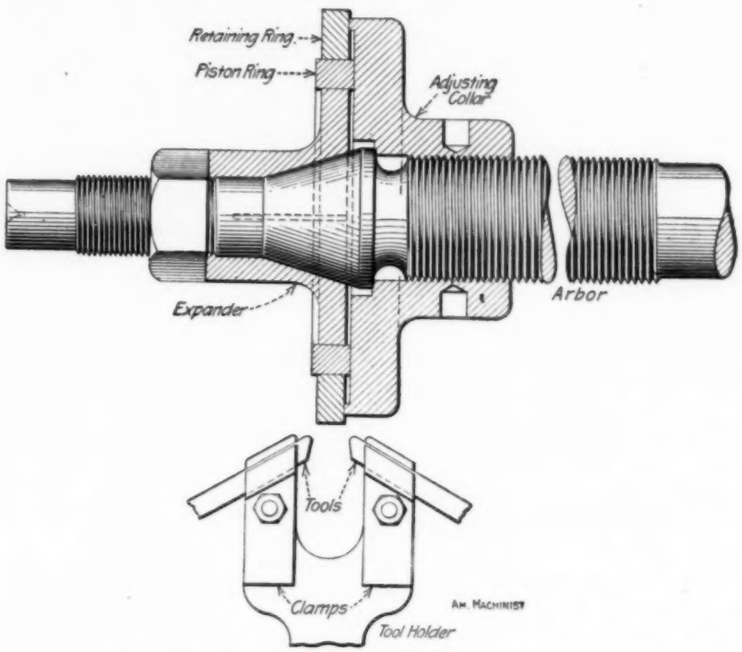
There may be nothing new under the sun, but there are many old things which too few of us know anything about. Common practice in one line of work is often entirely unknown in other lines. High-speed grinding spindles are run almost without lubrication in some cases and bearings are very different from the large machines. In small precision machines, hardened-steel spindles are run in cast-iron bushings. The spindle is ground and lapped and the bushings are also lapped to a mirror finish, although cast iron is not usually lapped in other machines. Watch factories have done this for years.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

A Piston Ring Facing Fixture

The illustration shows a fixture I am using for facing piston rings made in halves. This fixture is equally good for facing rings before and after splitting, as well as elliptic rings. Rings faced thus are positively parallel, and twenty-five ⅜-in. rings have been faced at one setting of tools with a total error of only 0.0035 in. These rings were 5 in. in diameter, elliptic, and made of hard cast iron.



FIXTURE FOR PISTON RINGS MADE IN HALVES

When the rings are in halves or split before facing, they can be removed without withdrawing the lathe centers. When the rings are solid, the fixture is usually bolted to the face plate and the tail center removed to take out the ring. Very little explanation is necessary in regard to its operation. The expander is split when it fits the taper part of the arbor to allow for expansion when the nut is tightened. The retaining ring is bored to fit the rings.

After the ring is inserted in the retaining ring, the adjusting collar is brought forward to the position shown. The piston and retaining rings are then slipped over the expander and pressed against the adjusting collar. The nut is then tightened slightly and the adjusting collar is locked away from the rings After this the nut is set home, and when the lathe starts, the adjusting collar can be run back on the arbor sufficiently to allow the tool-holder to work without interfering with it.

I have machined 400 rings made of cold-rolled stock, with practically no variation, and without once taking out the tools. I have also machined 100 eight-inch cast-iron rings, ¾ in. wide, without grinding or resetting the tools. By running at high speeds, say 150 ft. per minute, the finish is equal to the best grinding, and the work is accurate.

Newark, N. J. J. W. THAYER.

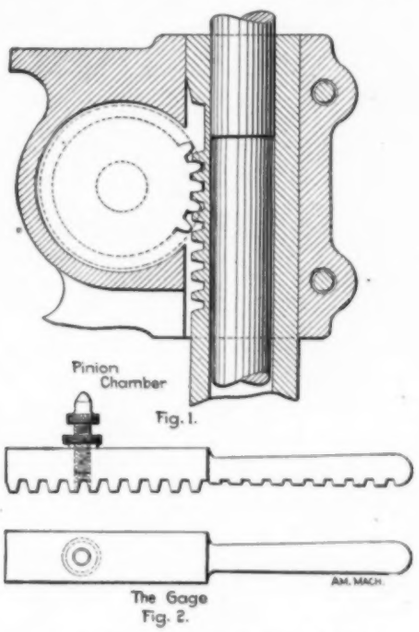
An Inexpensive and Accurate Milling Gage

The following is a description of a handy and inexpensive gage the use of which is in no way confined to the particular job mentioned.

We had an order for several vertical cock borers in which the reamer is fed into the work by means of a pinion engaging with a racked sleeve carrying a rotating spindle.

A sectional view of the pinion chamber showing the pinion, which has a horizontal shaft, in engagement with the sleeve sliding in a vertical bearing in the machine body is shown in Fig. 1. Slight variations in the castings due to the coring of the bearing holes, was the cause of some difficulty in boring the holes so that the pinion and rack worked freely and without backlash.

We overcame this by slightly varying the amount milled off the sleeves preparatory to cutting the teeth. To accurately determine this amount, the gage, Fig. 2, was made. It consists of a piece of ordinary rack, the same pitch as the pinion, a portion of its length being turned down to form a handle. About 1½ in. from the end of the toothed portion a fine-thread pin is fitted. This pin has a hardened ball end and may be locked by a milled nut.



AN ACCURATE MILLING GAGE

After the machine body is bored the pinion is placed in position, the gage is then put in mesh with it and the screw adjusted until it touches the far side of the sleeve bearing. This can be felt by rocking the gage on the pinion. The gage is then withdrawn and placed alongside the sleeve on the table of the miller, which is then set so that the ball point of the adjusting screw touches the edge of the cutter, in this way insuring the necessary amount being milled off the sleeve for proper engagement with the pinion.

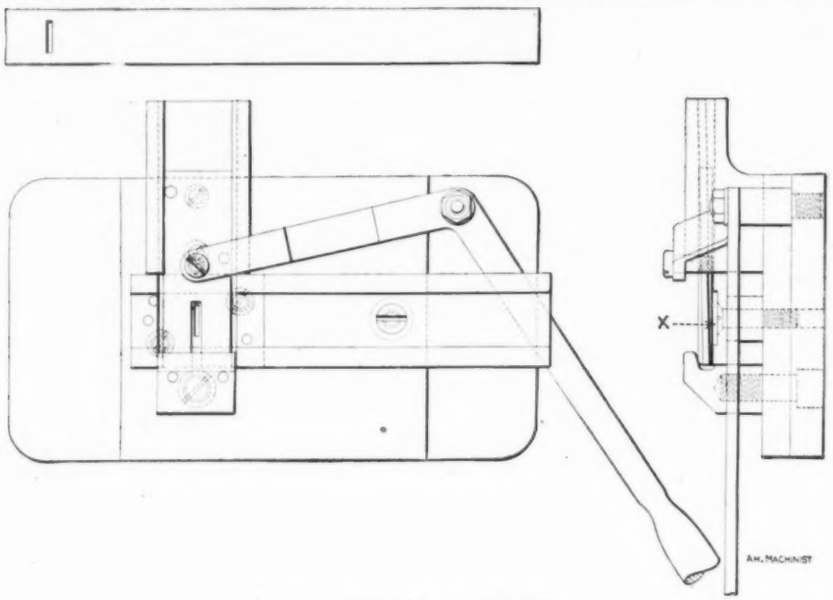
The use of the device in racking operations eliminates the necessity of allowing the "clearance" at the roots of the teeth.

Birmingham, England. J. HILL.

An Unusual Type of Stripper

The illustration shows a piercing die which was built "different," to meet a rather peculiar condition.

The piece to be pierced, which is also shown, is a strip of ⅛-in. Norway iron



AN UNUSUAL TYPE OF STRIPPER

1¼x12 in. The proximity of the slot to the end of the work rendered a solid stripper of the ordinary type useless, the dragging of the piece having a binding tendency upon the punch, thus making clean stripping an impossibility and often breaking the punch.

To overcome this trouble the stripper illustrated was placed on the die. As will readily be seen from the end view of the die, the sliding stripper is wedged tightly upon the work *X* during the piercing and stripping, and the binding action is eliminated.

W. R. HUMELBAUGH.

Rochester, N. Y.

Lighting an Old Forge Shop

I have been very much interested in the lighting schemes discussed in the AMERICAN MACHINIST, as I have strongly advocated the use of tungsten lamps, and at present am equipping a large manufacturing plant with them.

The first part of this plant to have a new lighting system installed was originally supplied with direct current from a small generator driven by the steam engine furnishing power for manufacturing. During the past year this steam-engine drive has been supplanted by individual motor drive for each department, using 440-volt, 3-phase, 60-cycle alternating current from a new central turbine generator power house which supplies the entire plant; and the lighting circuits are supplied through step-down transformers, giving 118 volts at the transformers.

In the forge shop shown in Fig. 1, there originally were five direct-current arc lamps which would have to be replaced or changed to operate on alternating current. These lights were only for use in the early morning and the late afternoon during the shorter days. In the morning before the forges are in operation, and about the middle of the afternoon, it is necessary to have some general lighting. Tool setting and repairing are still done by forge light, as the location of the machines and forges and the construction of the building are such that extension cords are impractical, and the light from the forges is sufficient.

The lights were installed as shown in Figs. 1, 2, 3 and 4. The building posts are 10-ft. centers, the lights in the main part being 40 ft. apart on each side, but staggered as shown. The circuits are controlled from a central panel board and arranged to illuminate according to the outside light, the central circuit, No. 2, being used more than the others.

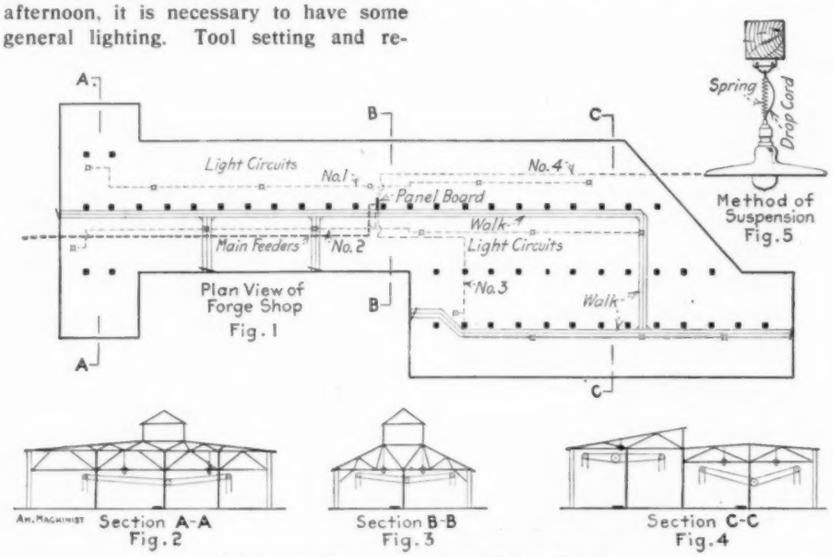
This shop is composed of four different buildings, as shown in Figs. 2, 3 and 4, and consequently the wiring and lamp suspension are irregular. With the exception of two lamps, they are all hung midway between trusses, the lower edge of the shades being level with the lower edge of the under beams. The main line-shaft is quite low, but the counters and the main line shown in the high part in Fig. 4 made it necessary to exercise care in spotting the lamps so that they would not be endangered by static current from the belts, or the belts running off the pulleys.

The lamps used are 100-watt, 117 to 113 volts, with an 18-in. Wheeler white-enameled steel reflector. The lower end of the filament is less than ½ in. below the shade, consequently the light is projected where it is wanted and after dark when the lamps are lighted it is impossible to see above the lower beams.

In Fig. 5 is shown a method of suspension where there is excessive vibration. One-piece fuseless rosettes are used throughout on account of their rigidity; a spring is hooked into the rosette, the lower end being taped to the drop cord. Where these springs are used the lamps are absolutely motionless, as the shade is very heavy. As these lamps are out of reach except from a high stepladder, and since the circuits are so arranged as to give light where wanted by throwing in the switches at the panel board, keyless sockets are used.

CURTISS F. SMITH.

Cleveland, Ohio.



LIGHTING EQUIPMENT IN A FORGE SHOP

Fr.	Decimal	Nearest 64th	Fr.	Decimal	Nearest 64th	Fr.	Decimal	Nearest 64th	Fr.	Decimal	Nearest 64th
1/64	0.0313	1/64	3/32	0.0938	3/32	11/64	0.1739		7/32	0.2593	
1/32	0.0323		13/128	0.0952		9/32	0.1765		17/64	0.2609	
1/30	0.0333		7/64	0.0968		5/16	0.1785		9/32	0.2632	
1/29	0.0345		1/10	0.1000		11/64	0.1818		11/40	0.2667	17/64
1/28	0.0357		5/32	0.1034		3/16	0.1852		7/32	0.2692	
1/27	0.0370		1/9	0.1053		13/64	0.1875	3/16	11/64	0.2727	
1/26	0.0385		7/64	0.1071		7/32	0.1905		7/32	0.2759	
1/25	0.0400		1/8	0.1111	7/64	15/64	0.1923		15/64	0.2778	
1/24	0.0417		9/64	0.1154		7/32	0.1935		9/32	0.2800	
1/23	0.0435		7/32	0.1176		1/5	0.2000	13/64	7/32	0.2813	9/32
1/22	0.0455		3/16	0.1200		9/32	0.2069		15/64	0.2857	
1/21	0.0476	1/21	1/8	0.1250	1/8	15/64	0.2083		29/128	0.2903	
1/20	0.0500		9/32	0.1290		7/32	0.2105		15/64	0.2917	
1/19	0.0526		15/64	0.1304		15/64	0.2143		17/64	0.2941	
1/18	0.0556		5/32	0.1333		9/32	0.2174		19/64	0.2963	19/64
1/17	0.0589		9/64	0.1364		15/64	0.2188	7/32	5/16	0.3000	
1/16	0.0625	1/16	11/64	0.1379		9/32	0.2222		19/64	0.3043	
3/32	0.0645		1/7	0.1429	9/64	29/128	0.2258		11/32	0.3077	
1/15	0.0667		9/64	0.1481		15/64	0.2273		21/64	0.3103	
3/28	0.0690		5/32	0.1500		9/32	0.2308		5/16	0.3125	5/16
1/14	0.0714		11/64	0.1538		15/64	0.2333	15/64	21/64	0.3158	
3/27	0.0740		3/16	0.1563	5/32	19/64	0.2353		11/32	0.3182	
1/13	0.0769	1/13	13/64	0.1579		15/64	0.2381		21/64	0.3200	
3/25	0.0800		7/32	0.1600		15/64	0.2400		11/32	0.3214	
1/12	0.0833		27/128	0.1613		15/64	0.2414		23/64	0.3226	21/64
3/23	0.0870		1/6	0.1667		1/4	0.2500	1/4	1/3	0.3333	
1/11	0.0909		11/64	0.1724	11/64	29/128	0.2580		23/64	0.3438	11/32
13/128	0.3448		17/64	0.4194		17/32	0.5161	33/64	17/32	0.5862	
9/26	0.3462		27/128	0.4211	27/64	33/64	0.5172		19/32	0.5882	
23/64	0.3478		7/16	0.4231		17/32	0.5185		33/64	0.5909	
7/20	0.3500		9/20	0.4286		33/64	0.5200		19/32	0.5926	
9/25	0.3529		29/64	0.4333		35/64	0.5217		17/32	0.5938	19/32
11/31	0.3548		19/64	0.4348		11/21	0.5238		9/16	0.6000	
5/14	0.3571		7/16	0.4375	7/16	19/32	0.5263		13/32	0.6071	
9/25	0.3600	23/64	29/64	0.4400		37/64	0.5294		39/64	0.6087	39/64
11/31	0.3636		9/20	0.4444		17/32	0.5313	17/32	39/64	0.6111	
11/30	0.3667		31/64	0.4483		35/64	0.5333		13/32	0.6129	
7/19	0.3684		15/32	0.4500		19/36	0.5357		27/64	0.6154	
19/52	0.3704		29/64	0.4516	31/64	37/64	0.5385		19/32	0.6190	
3/8	0.3750	3/8	31/64	0.4545		11/20	0.5417		39/64	0.6207	
13/35	0.3793		11/24	0.4583		39/64	0.5455	39/64	3/8	0.6250	3/8
11/29	0.3810		15/32	0.4615		37/64	0.5484		41/64	0.6296	
9/24	0.3846		31/64	0.4642		11/20	0.5500		19/32	0.6316	
23/64	0.3871		7/15	0.4667		19/36	0.5517		43/64	0.6333	
7/18	0.3889		15/32	0.4688	15/32	39/64	0.5556		17/32	0.6364	
25/64	0.3913	25/64	33/64	0.4706		19/32	0.5600		41/64	0.6400	41/64
13/34	0.3929		17/36	0.4737		37/64	0.5625	9/16	11/16	0.6429	
2/5	0.4000		33/64	0.4762		39/68	0.5652		45/64	0.6452	
13/32	0.4063	13/32	17/32	0.4783		17/30	0.5667		43/64	0.6471	
27/64	0.4074		35/64	0.4800	9/16	39/64	0.5714		13/32	0.6500	
11/27	0.4091		23/48	0.4815		37/64	0.5769		21/32	0.6522	
17/42	0.4118		35/64	0.4828	31/64	15/26	0.5789	37/64	43/64	0.6538	
13/32	0.4138		19/40	0.4839		19/32	0.5806		45/64	0.6552	
29/64	0.4167		1/2	0.5000	1/2	39/64	0.5833		23/32	0.6563	21/32
2/3	0.6667	43/64	3/4	0.7500	3/4	27/32	0.8334		53/64	0.9130	
31/64	0.6774		49/64	0.7586		55/64	0.8387		15/16	0.9167	
43/64	0.6786		25/32	0.7600		27/32	0.8400		59/64	0.9200	
17/25	0.6800		39/64	0.7619		43/64	0.8421		15/16	0.9231	59/64
45/64	0.6818		13/16	0.7647	49/64	29/32	0.8438	27/32	59/64	0.9259	
11/16	0.6842		51/64	0.7667		15/16	0.8462		61/64	0.9286	
11/16	0.6875	11/16	19/24	0.7692		17/20	0.8500		31/32	0.9310	
45/64	0.6897		39/64	0.7727		29/32	0.8519		63/64	0.9333	
29/64	0.6923		25/32	0.7742		55/64	0.8571	27/32	59/64	0.9355	
15/16	0.6957		7/9	0.7778		29/32	0.8621		15/16	0.9375	15/16
7/10	0.7000		25/32	0.7813	49/64	15/16	0.8636		61/64	0.9412	
19/27	0.7037	45/64	51/64	0.7826		29/32	0.8667		31/32	0.9144	
47/64	0.7059		11/16	0.7857		29/32	0.8696		63/64	0.9474	
17/24	0.7083		19/24	0.7895		57/64	0.8710		19/20	0.9500	
37/64	0.7097		53/64	0.7917		7/8	0.8750	7/8	59/64	0.9524	31/32
5/7	0.7143		39/64	0.7931	31/64	59/64	0.8800		21/32	0.9545	
33/64	0.7188	33/64	7/8	0.8000		15/16	0.8824		23/24	0.9565	
29/64	0.7200		29/32	0.8065		29/32	0.8846		23/24	0.9583	
13/18	0.7222		57/64	0.8077		7/8	0.8889		47/48	0.9600	
31/43	0.7241		13/16	0.8095		29/32	0.8929	57/64	29/32	0.9615	
17/24	0.7273		53/64	0.8125	13/16	15/16	0.8947		31/32	0.9630	
13/18	0.7308		27/32	0.8148		29/32	0.8966		27/28	0.9643	
11/15	0.7333	45/64	55/64	0.8182		15/16	0.9000		29/30	0.9655	
37/64	0.7368		29/32	0.8214		29/32	0.9032		29/30	0.9667	
19/27	0.7391		59/64	0.8235		15/16	0.9048		31/32	0.9678	
39/64	0.7407		15/16	0.8261		29/32	0.9063	57/64	31/32	0.9688	31/32
39/64	0.7419		61/64	0.8276	57/64	15/16	0.9091		63/64	1.0000	

DECIMAL EQUIVALENTS OF FRACTIONS AND NEAREST EQUIVALENT 64THS

Decimal Fractional Equivalents

I had occasion some time ago to lay out a proposed room in our factory on a scale of 1 in. = 1 ft. After the drawing was made the carpenters and millwrights were told to scale the drawing for measurements not shown.

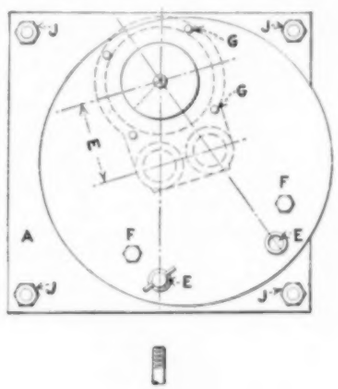
When measuring with their rules graduated in 16ths, they ran across such problems as 1/3, 2/3 and 5/6 in. and had no way of determining the nearest 16th to these fractions, as no tables were available. This led me to get up the inclosed tables, which can be used not only by carpenters and millwrights but any others who do not happen to own a rule showing foot divisions.

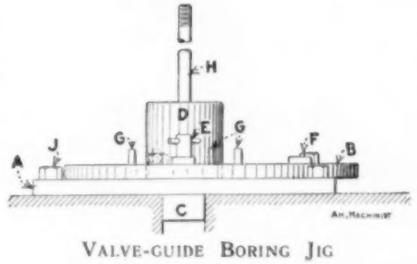
Indianapolis, Ind. G. W. LINN.

A Jig for Boring Valve Guides

The cuts show a jig used for boring valve guides, faces and tapping for valve plugs.

This jig is simple in construction. A square plate is shown at *A* with the end *C* turned to fit the boring-mill table. A round disk *B* has a hole diameter *d* equal to the cylinder bore. This is bored at a distance *E*, equal to the horizontal distance between the crankshaft and the camshaft, from the center of the disk.





VALVE-GUIDE BORING JIG

A plug *D* is turned to a nice fit for the cylinder bore and fastened on to the plate *A*; *EE* are locating holes for the valve centers; *FF* are setscrews for holding the plate *B* to the plate *A*. The small pins *G* are for locating the cylinder by the stud holes in the flange.

A long stud *H* goes through the hole in the cylinder top and fastens the cylinder to the disk *C*. The bolts *J* are for holding the whole jig on the boring-mill table. The operations are performed as follows: The cylinder, already bored and the bottom flange drilled, is placed in position, fastened down and the locating pin *E*

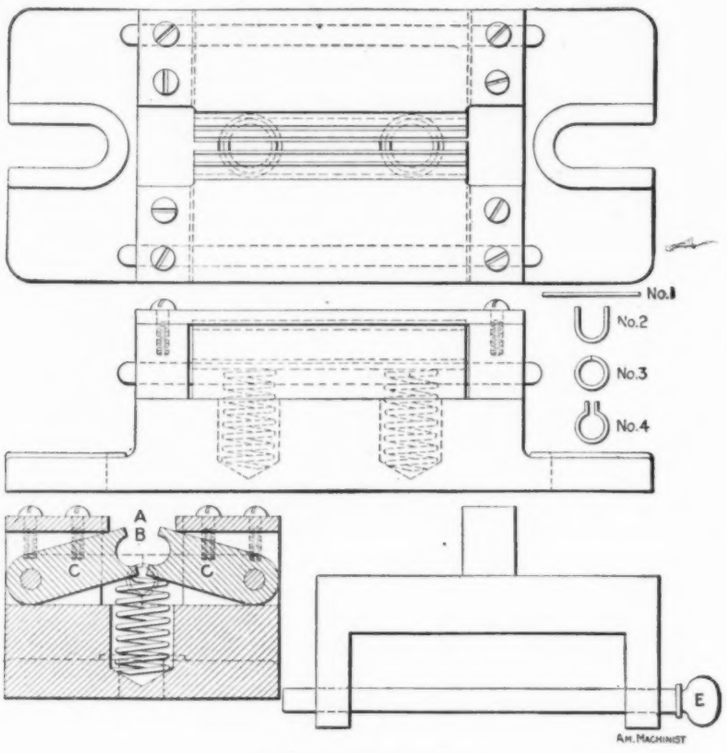
brought through the spark plug or other hole. The valve guide is then drilled and faced and the valve plug tap run down and the machine reversed to run the tap back. The whole time is under 30 minutes for a cylinder of 4-in. bore. The jig is made of cast iron with the exception of the locating studs, pin and setscrews, and will amply repay its cost many times over.

I may add that the firm using this jig is quite a small one and is manufacturing a type of high speed kerosene engines.

Batley, England. W. E. PEEL.

Forming a Tube in One Operation

In Vol. 35, page 605, you show a forming die forming a tube in one operation of the press. I doubt very much if this is practical, as my experience has been that in forming the piece the sides tend to be out of parallel rather than in, and that in attempting to form them over in a tube, the metal will sometimes buckle back.



A TUBE-FORMING DIE

The illustration shows a die for this purpose which always gave excellent results even on material with spring to it. This device can be used for many different shapes other than round, either open, closed or with extending arms, as shown. It is generally used on the foot press, as it is a little more dangerous than the ordinary die.

The blank is placed at *A*, and when the punch passes through *B* with the blank under it, the latter assumes shape No. 2; and then (the springs keeping the rocking parts *CC* in position, as shown) as the punch completes the stroke the rockers form the blank around the forming pin *E*. As the punch returns the finished article is taken up with the punch with the forming pin in place. By drawing out the pin the article is stripped therefrom. After putting the pin and the blank at *A* in place, everything is ready for making a finished piece.

W. M. HOERLE.

Pittsburg, Penn.

Drawing Office Suggestions

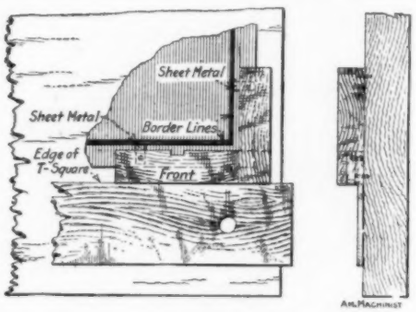
The article shown here is an illustration of a simple but extremely useful appliance. It is what may be termed a stamp guide. Most all drawing offices use the so called "Title Stamps," which, as a rule, are placed in the lower right-hand corner of the drawing. The device shown is designed to overcome the trouble encountered by the improper placing of such stamps.

As most all stamps are mounted upon wooden blocks, an ordinary block of wood may be cut out in the shape of a square, but it is better if made of two pieces, grooved and tongued at the ends, as shown, this style being more durable. The size of the pieces depends on the size of the stamps used. Two pieces of wood, or sheet metal, are inserted flush with the lower side, and project beyond the inner edge, the length of which depends upon the distance the edge of the stamp sets back from the edge of the wood, upon which it is fastened. A groove is cut on the inner edge of the front side; this is to allow sufficient play for the tack head, indicating the front side of the stamp.

Two steel pins, as indicated, are driven, and the projecting ends sharpened. The side marked "Front" is placed against the T-square, and shifted until both sides are parallel with the border lines, as shown, and then pressed downward; the pins which have been driven, are now holding the guide in position, and preventing it from slipping. The stamp is then pressed upon the drawing or tracing in the usual manner, with the exception of holding it close to the guide. The result, when taking the outfit away, is a clean and straight print.

I would like also to suggest a scheme for removing an imprint which has been improperly placed. Stamp-pad ink is more or less greasy, and dries slowly, and if an attempt is made to erase before it is dry, it is bound to smear and cause no end of trouble before the imprint has been entirely removed. The following method can be used with excellent results:

While the ink is moist, sprinkle the imprint freely with pumice stone, and rub well with a soft, dry cloth. All traces can be removed in a few minutes, leaving the surface of the tracing uninjured. I would say, however, that this applies to tracing cloth only, and must be done before the ink is dry.



STAMP GUIDE FOR THE DRAWING ROOM

GEORGE H. MASON.

Bridgeport, Conn.

It is a far cry from the old-time watchmaker who wrought every part himself, to the factory operative who knows one machine turning out a very limited portion of the works of the finished watch. Were the making of watches the chief end of man, the highly segregated activity would be ideal. There are so many other things requisite, however, to insure life, liberty and the pursuit or happiness, that true composite efficiency demands, at least, such rotation of function as will prevent the dwarfing of individual development.—*Engineering Magazine.*

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Of this issue, 25,000.

None sent free regularly, no returns from news companies, no back numbers.

OUTLINE OF TOPICS, PAGE 229

American Machinist

Abusing the Catalog Privilege

We are all apt to look upon the privilege of receiving catalogs free as something that belongs to us by right. But it takes but a moment's thought to show that it is a privilege and not a right of any kind.

Privileges can be abused, and this one is no exception, although the abuse may not be one that seriously disturbs the senders of catalogs and circulars.

Among machine-tool builders there is a growing tendency to make use of books, or treatises, showing the use and application of their machines, as well as giving descriptions of their features. Many of these books are handsomely prepared and each copy represents a considerable cost. Therefore it is nothing but natural that requests for them should be scrutinized.

The particular abuse in this direction that has been called to our attention is among students in engineering colleges. And here the abuse is not so much the asking for catalogs by persons who will make no immediate use of them, as it is the failure to state plainly who the would-be recipient is and what position he holds.

Two incidents will illustrate this point: A certain machine-tool firm offers to send a treatise describing the work that can be done to advantage on its machine. From a city in which there is a large technical college some fifty requests were received for this book. These requests were honored and the books sent. At the same time the names and addresses given were forwarded to the firm's local representative. This representative made an effort to get in touch with these fifty men. He succeeded in only three cases. The addresses to which he went were most of them rooming houses, where he was met by the landladies or persons in charge with scant courtesy and given but little information. Apparently he was looked upon as some kind of a bill collector. The report which he made was that the majority of these fifty men were students.

In every case a request was made by the firm sending the book that its receipt should be acknowledged and that the recipient state who he was and what position he held. Had this request received the common courtesy of a reply the firm would not have been to the expense of having a representative endeavor to locate these men. The failure to acknowledge the receipt of a catalog and answer the questions courteously asked is an abuse of the free catalog privilege.

The second incident is this: The same machine-tool building firm received a circular letter from one of the large engineering colleges of the East, stating that 250 men belonged to a certain college society and asking that 250 of the books referred to above be sent for the benefit of these students. The direct expense of filling this request, including the cost of the book itself, postage or express charges, etc., would have been about $150. It is doubtful if the treatise asked for is adapted to the needs of students, and the firm was perfectly justified in considering very carefully whether or not such a request could be honored.

The value of furnishing information to engineering students with regard to machines and products cannot be denied. There is probably no machine-building firm in the country which would hesitate to supply such information. At the same time, the receiving of such a courtesy places an obligation of courteous treatment in return. If a card is sent with a book or catalog asking that its receipt be acknowledged and that certain information be given in order that the sender may be free from unnecessary expense and may have something upon which to base his further action, this request should be courteously received and the information sent.

Here as in many other cases it may be worth while to "put ourselves in the other fellow's place" and ask if we are completely justified in sending for something which we know to be of considerable value and which we expect to receive gratis.

Overhead Charges in Large and Small Plants Compared

When we analyze the difference in the cost of production in different shops making the same product, and find that this is sometimes less in the small shop than in the larger one we have the materials for interesting study.

This is the case presented by the comparison between the cost of locomotive parts, as made by the Locomotive Finished Materials Co., of Atchison, Kan., and those made by the Santa Fé shops, in Topeka.

The reason given by the railway officials is that the plant at Atchison, being of comparatively new construction and managed directly by the owners, can turn out work more cheaply than the large shop at Topeka. But here we are confronted with the usually accepted theory that combinations of capital and large shops mean lower production cost.

If this is not the case it is evidently a mistake to build large manufacturing plants, as usually constructed, both on account of the cost of the building, and the fact that the actual owners cannot be in direct contact with the men and the work. This is directly contrary to the theory of decreased cost of production in large plants, and in large quantities, although there are, doubtless, many things to be said in favor of the small shop.

It is undoubtedly true that many shops are equipped more elaborately than the production demands, and that this increases the overhead expense more than is often realized. The question of handling material by crane or by other means, has an important bearing on this, and there are many instances where shops, which are apparently handicapped by the lack of the latest devices, are handling material very cheaply. This is not because of any fault of the devices in question, but because these shops have found substitutes which answer for their particular work without a large outlay for shop equipment.

Whenever we find a small shop which is able to manufacture at lower cost than the large shops, it behooves us to investigate very carefully every phase of the matter before deciding that the small shop is necessarily the more economical. While there may be cases where this

actually occurs, it is probably safe to say that in a great majority of instances the reason for increased cost in the large plant is injudicious expenditure for buildings and equipment, which increases the constant overhead expense, or in the method of managing the large shop.

We do not believe there can be any question as to the economy of manufacturing on a large scale, when all conditions are carefully considered, and each department receives as much attention as in the small shops.

The Inexcusable Disaster

The sinking of the "Titanic" on her maiden voyage, aside from the heartrending loss of life, is a severe blow to those who have fancied that the construction of vessels had reached the point where they could be considered safe against all the natural perils of the sea. The fancied security of water-tight compartments is shown to be without foundation, unless it is shown that the bulkhead doors were not closed or that the construction of the compartments was not strong enough to resist the stresses brought on them. In either case, the White Star Line has little to be proud of.

The evident necessity of providing sufficient life-saving apparatus for everyone on board, together with means of handling it, is so fundamental, that its absence is difficult for a landsman to understand.

We dislike to criticize any man who is not able to defend himself, but it is difficult to see how any sane commander could risk not only his passengers, but his ship by persisting in the northerly course, after repeated warnings, and in maintaining the rate of speed credited to him. As he had the reputation of being a careful navigator, we can only conclude that he was obeying orders from his superior, the director of the company, who was among the passengers saved.

The first duty of any steamship company is to land passengers safely at their destination, the second is to provide for emergencies as fully as possible. The pitifully small number of life boats, inadequately manned and supplied, arouses resentment everywhere. It is not enough that the law was complied with. Even the captain of the "Titanic" said there were not enough of them before he sailed. Would the steamship company be justified in carrying but one life boat if that was all the law required or if there were no law on the subject?

But the providing of sufficient life boats is a small part of the necessary reform. There must be enough seamen to handle them. Out of a crew of 890 people only 65 were even listed as sailors. There were 475 stewards to make beds and carry cocktails, but who knew less about life boats than many of the passengers, and 360 in the engineering department. Additional life boats are of little value without sailors to lower and man them, and these should be provided as well as the additional boats which have been ordered while the matter is fresh in our minds.

We hear much about laws for the regulation of railroads, steamships and factories being unnecessary; that the companies themselves will do all that is necessary for their own interest. But experience shows that few of us do more of this work than the law requires, so that stringent regulations seem necessary in most cases.

This regulation must evidently extend to limiting the routes to be followed, with penalties and possible cancellation of insurance for violations. Imposing liability for damages similar to that imposed on land transportation might also have a deterrent effect on taking unnecessary risks.

Back of it all lies the craze for speed, not so much from the demands of passengers, as the companies would have us believe, as from the rivalry of companies in the struggle for commercial supremacy and free advertising.

It is very noticeable, however, that little has been said in any paper of the engineering force of the "Titanic;" not one being saved. Officers on deck can at least know what is going on. But the men far below decks, waiting for signals, and not knowing what is going on above, seem to be almost entirely forgotten. They at least deserve the recognition and honor that come from a duty well done.

But while we are shocked beyond expression at such a wholesale destruction of life, especially if we consider that it should have been preventable, we should not forget that the workshops and factories of this country claim double this number of adult victims each month. And as we know that many of these accidents are clearly preventable, it behooves us to hasten the change in conditions which will make the industries, as well as travel, safer for all concerned.

PERSONALS

R. Herz Sonnenthal, of E. Sonnenthal, Jr., Berlin, Germany, is at present in this country, with a view to completing agency arrangements.

William A. Rockenfield, until recently connected with the Bath Grinder Co., Fitchburg, Mass., has accepted a position as sales manager of the American High Speed Chain Co., Indianapolis, Ind.

W. A. Daley, of the Colcord-Wright Machinery & Supply Co., Kansas City branch, recently resigned to accept a position with the Eccles & Smith Co., San Francisco, Calif., as manager of their machinery department.

H. E. Strohm, who has been with the Colcord-Wright Machinery & Supply Co., St. Louis, Mo., for the past two years, will take charge of their interest at the Kansas City branch, succeeding Mr. Daley, resigned.

H. C. Phillips, formerly chief engineer of the Atchison, Topeka & Santa Fé Ry. coast lines, at Los Angeles, Calif., has been appointed chief engineer of the entire Santa Fé system, with offices at Chicago. The position is a newly created one.

W. R. Carson, until recently construction and plant engineer with the Taylor Iron & Steel Co., High Bridge, N. Y., resigned that position in order to accept one as electrical and mechanical engineer with the Grasselli Chemical Co., Cleveland, Ohio.

L. E. Schlotterbach, formerly manager of the automobile department of the Chicago Pneumatic Tool Co., has become general manager of the newly organized Schlotterbach Manufacturing Co., Newark, N. J. The new company is to manufacture the Koehler commercial car.

Cecil P. Poole, for the past seven years junior editor-in-chief of POWER, has resigned that position in order to engage in consulting engineering. He will enter into partnership on May 1 with Lamar Lyndon, of New York, and the headquarters of the new firm will be located at Atlanta, Ga. Mr. Lyndon's New York office will be continued as heretofore and will coöperate with the Atlanta office, which will be conducted by Mr. Poole.

OBITUARY

Jacob E. Friend, president of the Nordberg Manufacturing Co., Milwaukee, Wis., died at Florence, Italy, on Apr. 20. Mr. Friend had not been well for some time, and was traveling in Europe in the hope of improving his health.

Journal of Society of Hungarian Engineers

A forward step has been taken by the Society of Hungarian Engineers and Architects of America in connection with the publication of its journal. Beginning with the April issue, half of the text is in English, the other half in Hungarian.

The division is made according to the origin of the articles. Those dealing with Hungarian engineering developments are written in English, thus making them available for American readers. Articles dealing with American engineering are in Hungarian, thus making them of service to Hungarian readers of the journal who do not understand English.

The society is to be congratulated on this forward step, which will greatly increase the value of its journal. So far as we know, this is the first time that a foreign engineering body has printed its proceedings in English.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

A Helical Gear Shaper

The increasing use of the helical gear has induced the Fellows Gear Shaper Co., Springfield, Vt., to design a machine for this purpose, the principle of operation being identical with that of their regular gear shaper. The main difference between this and the older machine is the addition of a helical guide to the cutter ram, and a helical cutter. The other details, such as the work and cutter revolving together, are similar to the former machine.

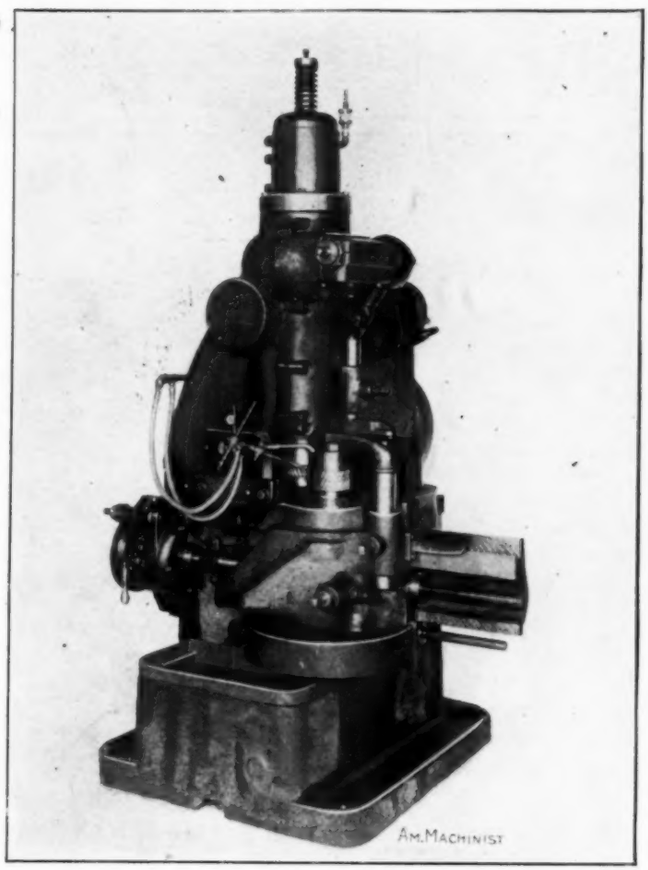


FIG. 1. FRONT VIEW OF HELICAL GEAR SHAPER

FIG. 2. THE OPERATING MECHANISM

Two views of the machine appear in Figs. 1 and 2, the helical guide being on top, as shown in detail in Fig. 3. This guide is a solid block of cast iron, planed to a helix, which is an exact continuation of the helix of the cutter's teeth. The mating guide is seated in an enlarged hub, bolted to the base of the index wheel.

Both guides are of large dimensions, the mating guide being split in the middle and provided with an adjustment for taking up wear, which, however, should be very slight, owing to the large bearing surfaces. These guides can be changed in from 10 to 15 minutes, and as each helix angle had its own guide, all possibility of error in calculating gearing is avoided.

The cutter drive is operated from the four-step cone pulley, shown in Fig. 2, a pinion on the shaft meshing with the gear *A*, in Fig. 5. This gear has a graduated slot for the sliding pin *B*, and through the connecting slot *C*, transmits the desired movement to the rock shaft *G*, which drives the ram *K* by means of the spur gear segment *H*.

The worm *E* adjusts the position of the stroke to agree with the location of the face of the gear being cut, the screw *Y* clamping this adjustment against further movement. The fixed guide *M* seats in the extended hub end of the upper index wheel *O*. The movable guide *P* is keyed to the cutter spindle *K*.

RELIEVING AND INDEXING MECHANISM

The relieving motion is secured by the double-throw cam *S*, keyed to the shaft *R* and operated by the gear A. The cutter *K*, with the attached mechanism, is mounted in the head casting *T* and is free to swivel through a short arc about the shaft *G*. The cam *S*, which bears on the roll *W*, throws this cutter head forward at the beginning of the cutting stroke.

On the return stroke, the cam bears against the spring-supported roll *V*, which swings the cutter free from the work. The positive stop *U* insures the cutting head being brought into the same position for every stroke.

The index mechanism is independent of both the cutter drive and helix mechan-

ism, the index worms revolving so slowly that it is possible to make them self-locking, so that the helical thrust of the cutter does not disturb their action. Both cutter and worm are revolved together, a single revolution of the latter completing the work in most cases. The feeding mechanism is identical with that of the regular gear shaper made by the company, and can be adjusted for either a single or a double cut, as desired.

As machines of this type require little clearance space for the cutters, it is possible to cut herringbone gears with a groove of from $\frac{3}{16}$ to $\frac{5}{16}$ in. between the two sections, the necessary allowance depending on the pitch and the helix angle.

The cutters for this machine are made like those for the spur-gear shaper, except that the teeth have the correct helix angle for the gear to be cut. The cutter is ground, after hardening, by a generating process, as with the cutters for spur gears.

The machine shown, which is designated as No. 30, will cut helical spur gears up to 18 in. outside diameter and 4 in. face space, with diametral pitches of 6 and 8 in cast iron and steel, respectively. On regular external spur gears it will cut up to 24 in. outside diameter and 4 in. face with diametral pitches of 6 and 7 in cast iron and steel. The speed is given as 51, 73, 114 and 160 strokes per minute, while the feed is 216, 286 and 418 strokes per inch of pitch-diameter of gear blanks.

Change gears are provided for spacing all numbers of teeth from 12 to 50, and all from 50 to 450, excepting the prime numbers and their multiples, and one pair of helical guides, right and left hand, of any helix angle desired up to 30 degrees.

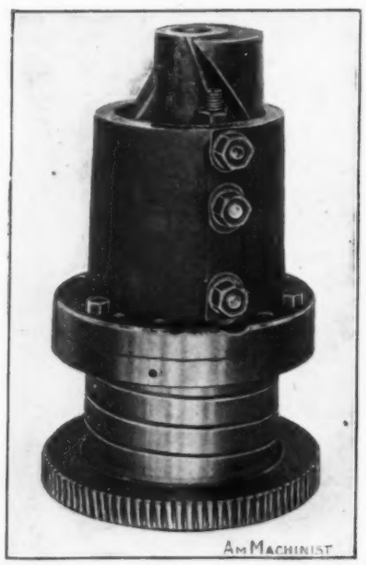


FIG. 3. HELICAL GUIDE AND RAM FOLLOWER

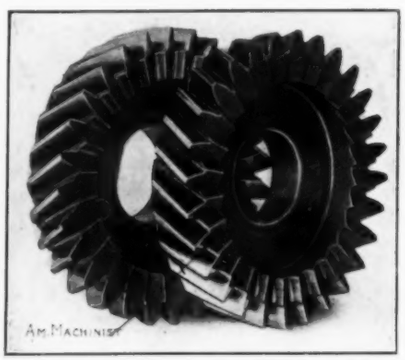


FIG. 4. HELICAL SHAPER CUTTERS

Upright Dial Gage

The upright dial gage shown has a travel of spindle of $\frac{3}{16}$ in. Its low and compact design makes it handy. It can also be arranged, with a small surface

UPRIGHT DIAL GAGE

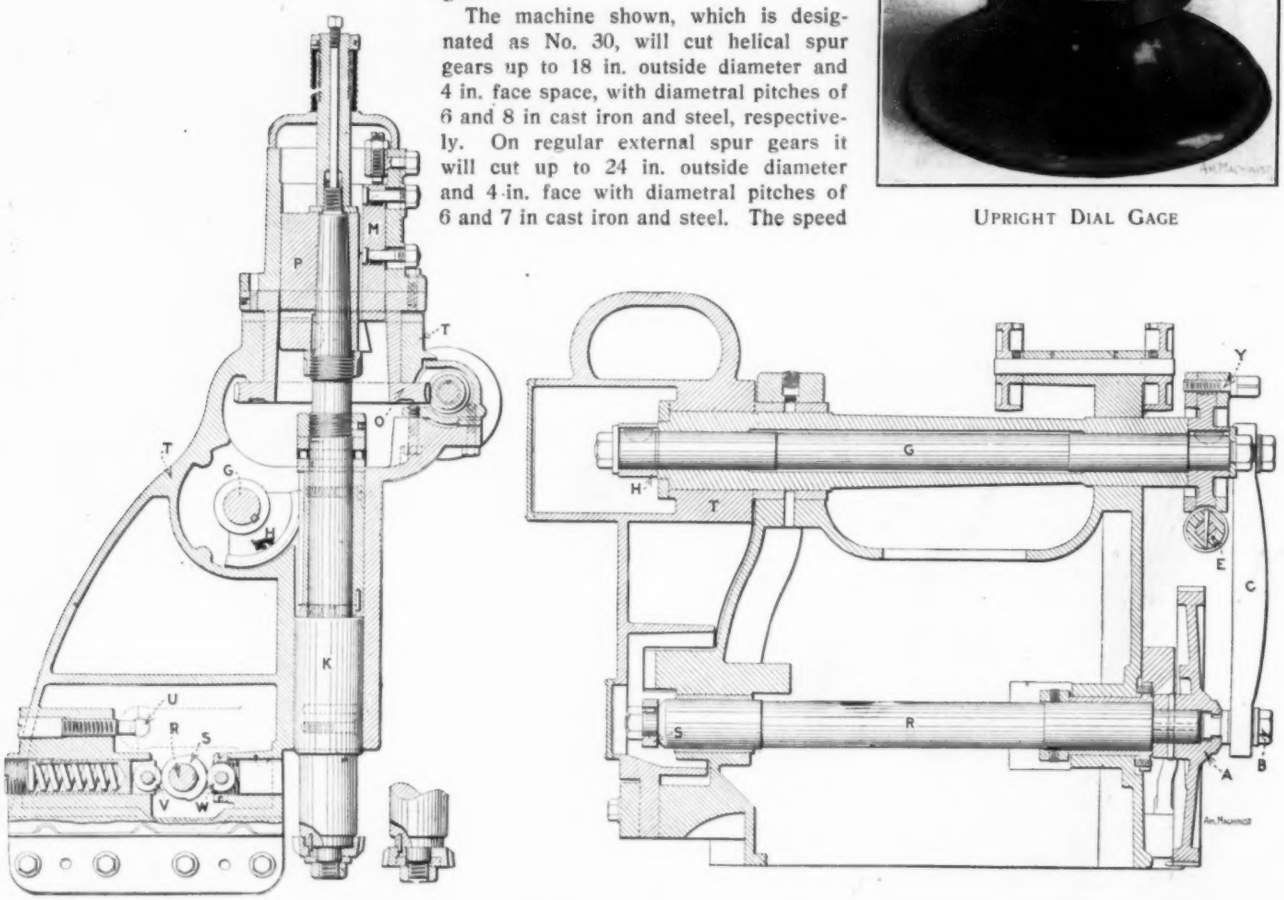


FIG. 5. DETAILS OF HELICAL GEAR-SHAPER MECHANISM

in place of the platen, to measure sheet metals and like substances which do not have flat even surfaces.

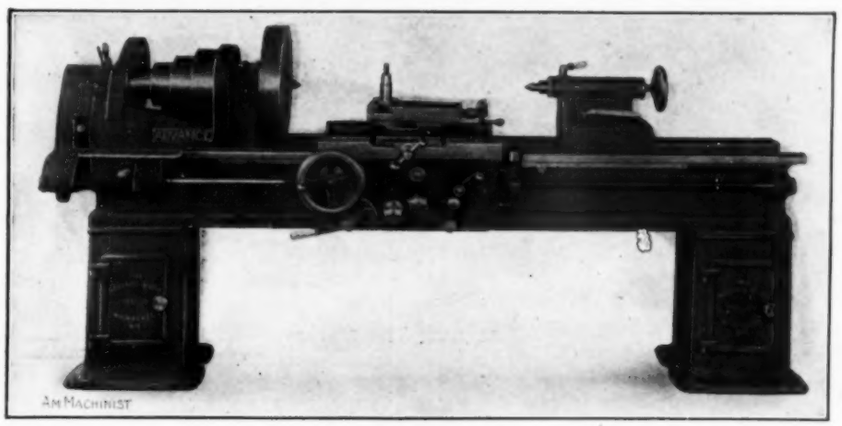
This gage is a recent addition to the line made by B. C. Ames & Co., Waltham, Mass.

Threading Lathe

In the description of the threading lathe shown on page 689 of last week's issue, mention of the Bickford Machine Co., Greenfield, Mass., as the manufacturers, was inadvertently omitted.

Heavy Duty Lathe

The lathe shown has the feed mechanism arranged in the apron within handy reach. There are 4 constant feeds, varying from 0.015 to 0.06 in. A large number of other feeds can also be obtained through the change gears, which are operated by the lever at the head end of the lathe.



HIGH-DUTY ENGINE LATHE

The apron is of double-plate construction, and has only one friction for both lateral and cross feeds. The lead-screw nut is provided with a stop, so that the feeds cannot be operated while chasing threads or *vice versa*.

The tailstock is of the setover type, and the compound-rest base is 9 in. wide. The top slide has a 5-in. travel, and the spindle, made of chrome-nickel steel, has a 1 9/16-in. hole. The lathe swings over the V's 18½ in., and over the carriage, 12 inches.

The machine is a recent development of the Advance Machine Tool Co., Milwaukee, Wis.

Adjustable Knurling Tool Holder

In this knurling-tool holder three knurls are employed as shown. By the use of three knurls a three-point contact with the material to be knurled is obtained, an advantage in cutting long pieces of small diameter. Each knurl also acts as a back rest, thus preventing the bending or straining of the piece on which the operation is being performed.

By the use of the winged nut and stud, the holder is adjustable for all round pieces ranging from 0 to 1¼ in. The universal features of the holder lie in the fact that it is not restricted in its adaptation to any one class of machines, but may be used on all types of machines having a revolving spindle in which the work can be held, such as engine lathes, bench lathes, drilling machines, millers, etc.

By using two right-hand knurls on the lower jaw and one left-hand knurl on the upper jaw, or *vice versa*, the tool will feed itself along any revolving piece of work.

This tool-holder is a recent development of the Alert Tool Co., 221 N. Broad St., Philadelphia, Penn.

ADJUSTABLE KNURLING-TOOL HOLDER

Clamping Devices

The illustrations show several clamping devices recently developed by Schuchardt & Schütte, 90 West Street, New York City.

The clamp shown in Fig. 1 is specially adapted for work having a flat margin or flange. The claw is pivoted eccentrically to a hexagon which permits six different heights.

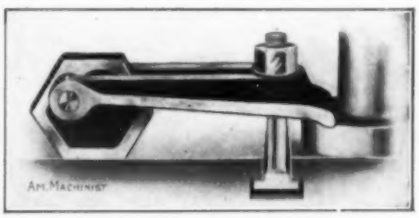


FIG. 1. CLAMP FOR WORK WITH FLAT MARGIN OR FLANGE

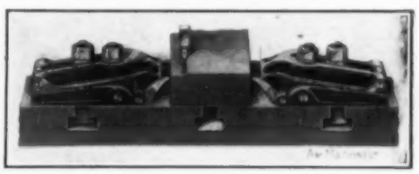
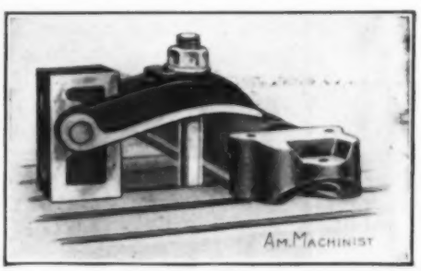


FIG. 2. FOR SIDE CLAMPING



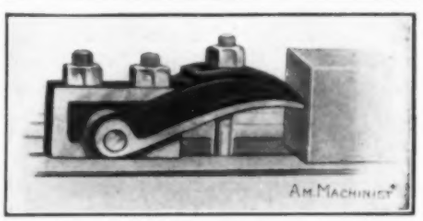


FIG. 3. COMBINATION CLAMPS

The device shown in Fig. 2 is for side-clamping work to be machined on the surface. Its design is clearly shown by the illustration.

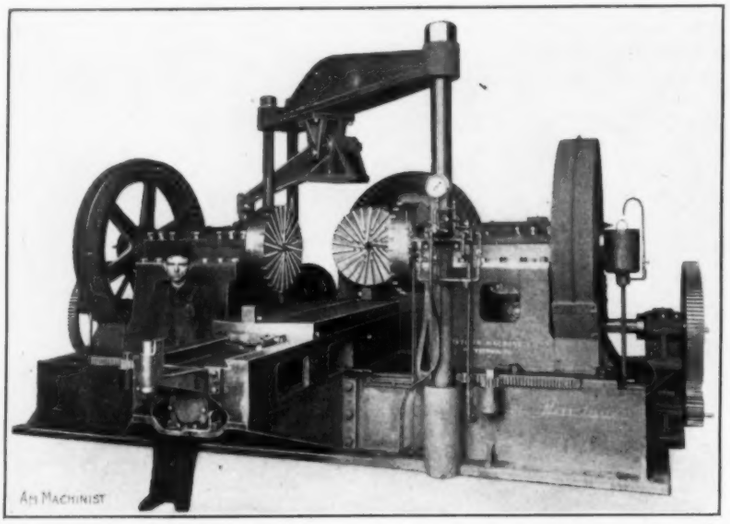
The combination clamps shown in Fig. 3 are for side or top clamping and afford four different heights.

Three-way Facing Machine

This machine is intended for facing flanges of large pipe fittings, valve bodies, etc. It is equipped with three 25-in. facing heads. Each head has 22 high-speed steel cutters. The spindles are 8 in. in diameter, driven by a spur gear 51 in. in diameter by 7½ in. face. It is driven

with a 35-hp. motor with a gear ratio of 256 to 1.

Each head is fed up to the work by an air cylinder, and the feed is controlled with an oil cylinder on the same piston rod. Each spindle is mounted on a head which is shiftable on the bed by means of a rack and pinion. The spindle which is mounted in a supplemental slide has a movement of 1½ in. representing the amount to clear the rough casting and finish to size.



THREE-WAY FACING MACHINE

The maximum distance between the front cutter heads is 45 in. or 23 in. from the center of the fitting. The two front heads will face up to a minimum distance of 9½ in. The height from the table to the center of the spindle is 16½ in. The table has a sliding and revolving top operated by air.

The work is held in position by a steel yoke over the top of the machine, equipped with a lever, and a pneumatic cylinder which is capable of exerting a pressure of fifty tons on the fitting. The different operations of the machine are accomplished by three air valves located on a stand attached to the column on the side of the machine. A gage is provided to show the pressure that is being applied to the fitting.

The machine weighs 60,000 lb. and is a recent product of the Pottstown Machine Co., Pottstown, Penn.

Gas-fired Furnaces for Various Uses

During the past year the Eclipse Fuel Engineering Co., Rockford, Ill., has developed an extensive line of gas-fired furnaces and gas appliances. Four furnaces for machine-shop uses are illustrated herewith.

A small, high-speed steel oven furnace, having an opening 4x8 in. and a depth of 12 in., is shown in Fig. 1. It is designed to heat rapidly and radiate slowly. Between the firebrick lining and the metal shell is a thick layer of special insulating material, applied in a cement form, so that it adheres to both and supports and strengthens the lining. The bottom brick, or hearth, is easily replaced.

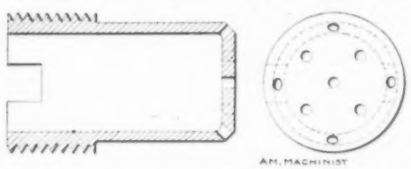


FIG. 3. STEEL BURNER TURNED AND CORED FROM THE SOLID

The substantial oven door is supported and counterweighted, as shown. This furnace was designed to meet the demand for a toolroom, gas-fired furnace to handle high-speed steel tools.

A radiation or cooling curve from one of these furnaces is shown in Fig. 2. At the time of the test it was brought up to a working temperature, about 2200 deg. F. A Brown pyrometer was inserted, the gas and air cut off and temperature readings taken at frequent intervals for a period of four hours. These readings were plotted into the curve shown.

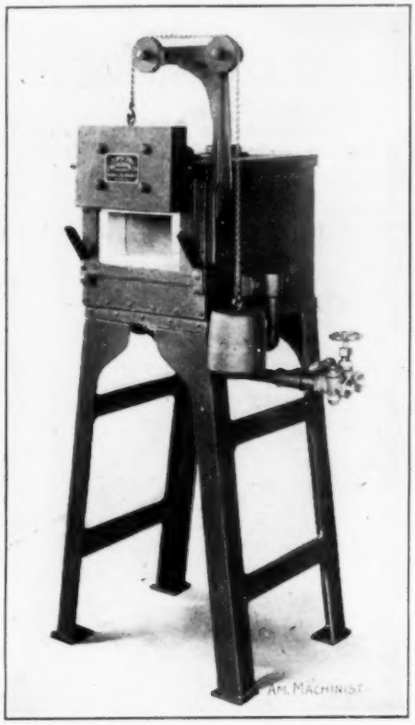


FIG. 1. HIGH-SPEED STEEL OVEN FURNACE

The temperature at the beginning was 2200 deg. F.; at the end about 730 deg. F. It will be noticed that after the rapid initial drop, the curve is a straight line. Such a furnace retains its heat for a long period, for at the end of the first hour it had a temperature of 1400 deg. Fahrenheit.

A uniform feature of all these furnaces is the steel burner shown in outline in Fig. 3. It is turned and bored from the bar, and inserted from the side as shown, using a T-wrench.

An oven furnace for case-hardening, that is made in four sizes, is shown in Fig. 4. In all, the opening is 10x16 in. The depths are 18, 22, 32 and 42 in. The

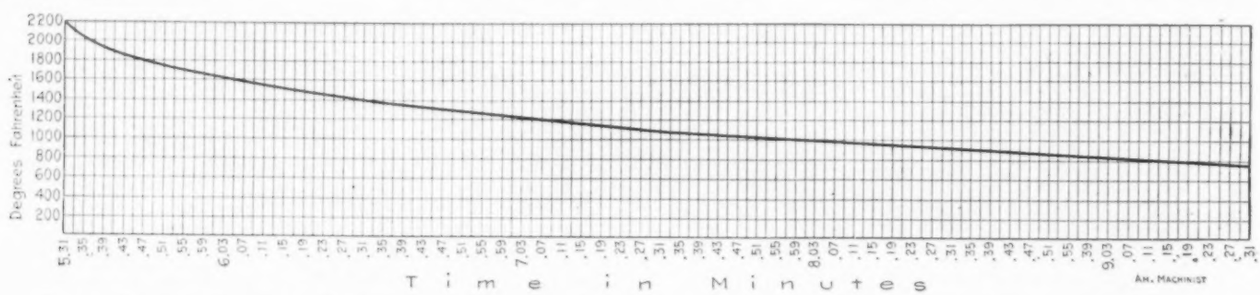


FIG. 2. COOLING CURVE OF HIGH-SPEED STEEL OVEN FURNACE. READINGS TAKEN EVERY TWO MINUTES FOR FOUR HOURS

illustration shows the general construction, the type of door with a loading shelf beneath and the arrangement of burners.

A lead-hardening, or bath, furnace, is shown in Fig. 5. The pots furnished are all drawn steel. Thus, the outside diameters are uniform, giving an annular space between the pot and lining of a uniform section. The thickness of the pot is much less than that of a corresponding cast-iron pot, thus it heats more quickly.

The rim of the pot rests upon a cast-iron expansion ring; thus expansion and contraction do not bring any stress upon the lining. Gas enters through four burners, two on each side. These are set tangentially, so that the flame plays into the annular space around the pot and does not strike it directly. Waste gases escape through a flue at the rear. These furnaces are made for four sizes of drawn steel pots, 6x12, 8x12, 8x10 and 8x18 inches.

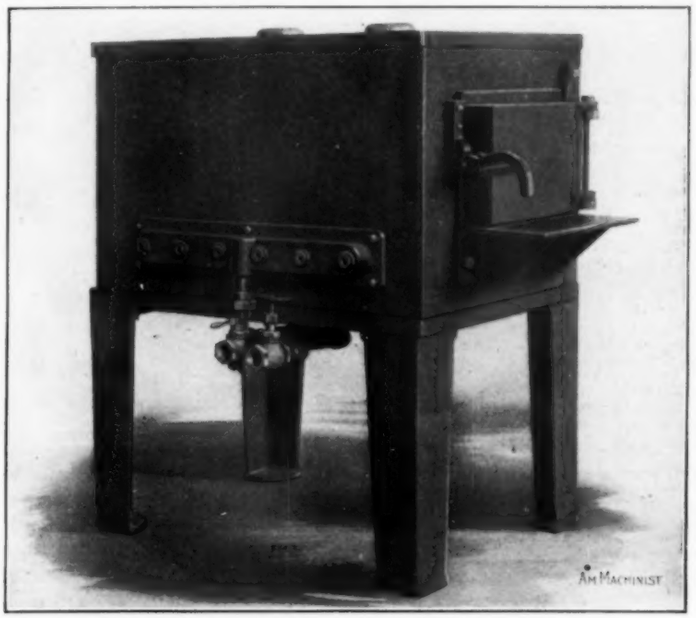


FIG. 4. CASE-HARDENING OVEN FURNACE

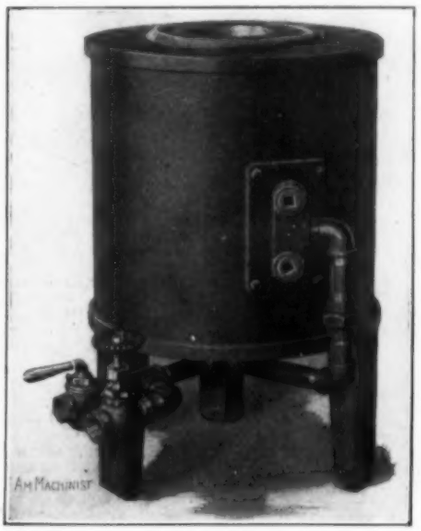


FIG. 5. LEAD-HARDENING FURNACE WITH STEEL POT

FIG. 6. CYANIDE FURNACE WITH HOOD

A cyanide furnace with hood is shown in Fig. 6. The construction is similar to that of the lead-hardening furnace, and also uses a drawn-steel pot. In fact, all pots furnished for machine-shop use are of drawn steel, instead of cast-iron or cast steel.

Templates for Unsymmetrical Gear Teeth

BY A. H. STANG

A spur gear is sometimes wanted to mate with an existing worn, unsymmetrical gear. The kinematics texts give various methods for finding the required template but most of them call for celluloid or other transparent material which is, to say the least, very hard and unsatisfactory to work with. I have found the following method very satisfactory on account of its simplicity and the accuracy of which it is capable. Suppose we have the pinion-tooth outline and want the gear.

On a piece of stiff paper, lay out two teeth of the pinion, outlined from the part itself. Find or assume a pitch circle and divide it into sixteenths of an inch and draw radii through these points to the addendum circle. Number the radii from one side of the template to the other. Carefully cut out the two teeth, the template including the center of the pinion.

On another piece of paper draw the pitch circle of the required gear, and also the addendum. Divide this pitch circle into sixteenths and draw radii through the points to the addendum. Number these so as to correspond to the pinion numbering. Lay off on the drawing board a line the length of which equals the sum of the pitch radii of the pinion and gear. Through the proper centers of the templates, stick a thumb-tack and place the tacks at the extremities of this line. Stretch a black silk thread between the tacks. This will be directly over the line of centers.

Bring radius No. 1 of each paper under the thread and, on the gear paper, which is underneath, draw the outline of the teeth of the pinion template. Bring radius No. 2 of both templates under the string and proceed as before. Continue the operation until the angle of action has been recovered, when the template of the mating gear is complete. This gear-tooth template is, obviously, that part of the gear paper inside of the envelope of lines.

Vanadium occurs in nature in the form of salts that are analogous to phosphoric acid. The ores that contain these are reduced, and the pure vanadium extracted therefrom is a hard, dense metal with a silvery white color. It has a very high melting temperature and cannot be used in steel until it has been alloyed with pure iron in electrically heated furnaces. This ferro-vanadium will then melt in and thoroughly combine with the molten steel.—*Automobile.*

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

METAL WORKING

NEW ENGLAND STATES

The American Can Co. will build a large addition to its factory, at Lubec, Maine.

The General Electric Co., Boston, Mass., will erect a new factory at the river works, Lynn, Mass.

The contract has been awarded for the construction of a new garage, at Palmer, Mass., for W. E. Woodmansee and Frank Lamont, of Springfield, who have formed a partnership and expect to begin business May 10.

J. H. Quinn, Spencer, Mass., will erect a garage.

Charles H. Alderman, Springfield, Mass., will erect a garage, at Dickinson St., to cost $6000.

The Crane Valve Co., Bridgeport, Conn., will erect a three-story building and several additions to its factory.

The Pope Mfg. Co., Hartford, Conn., automobile manufacturer, has let the contract for the erection of a four-story plant. Noted Mar. 28.

Plans have been completed for the erection of the new forge shop for the Blakeslee Forging Co., Plantsville, Conn. It will be 50x220 ft., one story, of brick mill construction. Bids will be received by A. E. Greene, engineer, Hartford, Conn.

MIDDLE ATLANTIC STATES

A tool house, 40x160 ft., is being added to the plant of the Remington Arms Co., Ilion, N. Y.

A three-story garage at 9-11 West One Hundredth St., New York, N. Y., occupied by H. Lambert, was damaged by fire, Apr. 23. Loss, $20,000.

The building at 108 West End Ave., New York, N. Y., occupied by the Garford Garage Co., was damaged by fire, Apr. 18. Loss, $1000.

Work has commenced on an additional building for the plant of the H. H. Franklin Mfg. Co., Syracuse, N. Y., to cost between $35,000 and $50,000. The building will be 150x200 ft., and will contain space for a machine shop, chassis testing room, and a repair shop. The company manufactures automobiles and does cast work.

The Sagamore Garage Co. has broken ground for the erection of a new garage at the corner of West Main and Spring Sts., Oyster Bay, N. Y. The building is to include a modern repair shop.

Plans have been completed for a one-story addition, 125x133 ft., to be built for the Rome Wire Works, Rome, N. Y. It will be of steel and brick. H. T. Dyett is president.

The factory of the L. L. Jones Co., Preston Building, Atlantic City, N. J., manufacturer of lighting fixtures, now being erected at Drexel and Virginia Aves., is nearing completion.

Fire in the plant of the Heller Tool Co., on Verona Ave., Newark, N. J., caused damage to the extent of $8000.

The Sheely Motor Co., Passaic, N. J., is constructing a large modern garage, at 450 Main Ave.

The machine shop of the Allentown Rolling Mills, Liberty St. and the Lehigh Valley R.R., Allentown, Penn., was completely destroyed by fire, Apr. 22. The shop was about 350x80 ft., and was equipped for the manufacture of fine machinery, such as electric pumps, ore crushers and various types of mining machinery. H. W. Allison is secretary and treasurer.

Plans have been drawn for Gallagher Bros., Chester, Penn., proprietors of the garage on West Seventh St., for the construction of an addition to the present garage. The new building will be of modern fireproof construction and will accommodate 25 cars.

The contract has been awarded for the construction of a stone garage, 43x61 ft., 2½ stories high, for Louis Wolf, Elkins Park, Penn.

The garage of John S. Newbold, at Jenkintown, Penn., was damaged by fire, Apr. 15. Loss, $2500.

Martin J. Mulkin, North American Building, Philadelphia, Penn., will erect a stone garage, 2½ stories high, 40x50 ft. The contract has been awarded.

The Pennsylvania Galvanizing Co. is having plans prepared for the construction of a five-story brick factory, 141x132 ft., at Twenty-second and Race Sts., Philadelphia, Penn.

P. A. Leggee has let the contract for the construction of a garage at Fifty-second St. and City Ave., Philadelphia, Penn.

E. B. Gardette has let the contract for the erection of a garage at Wissahickon and Mahiem Sts., Philadelphia, Penn.

A permit has been granted to Y. W. Tillman, Philadelphia, Penn., for the erection of a brick garage, at 2212 Atlantic St.

S. L. Allen & Co., manufacturers of agricultural implements, have let the contract for the erection of a large addition to their plant, at Fifth and Glenwood Aves., Philadelphia, Penn.

Work has commenced on the erection of a four-story factory addition to the plant of Haines, Jones & Cadbury, at Nos. 1111 and 1123 Hamilton St., Philadelphia, Penn. The firm manufactures plumbers' supplies.

William Miller, 5948 Torresdale Ave., Tacony, Philadelphia, Penn., will erect a two-story garage, 20x25 ft. The contract has been awarded.

The Germantown Tool Works, recently destroyed by fire, will rebuild its plant, consisting of seven 1-story buildings, at Germantown, Philadelphia, Penn.

R. W. Birdsell has let the contract for a two-story stone garage at Sixty-sixth and Callum Sts., Philadelphia, Penn.

R. Morgan has let the contract for a two-story garage at 8900 Germantown Ave., Philadelphia, Penn.

The Reading Steel Casting Co., Reading, Penn., will erect an addition to its plant at Tulpehockenn, Penn.

Bishop & Ports, Inc., Pittsburg, Penn., are remodeling their three-story livery barn into a modern garage and salesroom. The building has a 100-ft. frontage on Walnut St.

The American Copper Rolling Co., Sharpsville, Penn., will build a rolling and welding plant, at Trout Island, near Sharpsville. Jacob Roth is president.

The Valley Mould & Iron Co., Sharpsville, Penn., will build an addition, 240x75 ft., to its plant.

The Croxton Motor Car Co., Cleveland, Ohio, will move to Washington, Penn. A new plant will be constructed. J. P. Stolz is president.

The United Railway & Electric Co., Continental Building, Baltimore, Md., is having plans prepared and bids will be received until about May 1, for a new car barn to be built near Weber Park. Baldwin & Pennington, Professional Building, are the architects. The structure will be of brick and stone. The estimated cost is $150,000.

The Eastern Auto & Garage Co., Baltimore, Md., has awarded the contract for erecting a one-story garage and machine shop, 180x49 ft., at Philadelphia Ave. and Curley St.

Work has been commenced on the erection of the new roundhouse and shops for the Western Maryland Ry., at Millersville, Md.

The plant of the Heller Tool Co., Verona Ave., Newark, Md., was destroyed by fire, Apr. 23. Loss, $8000.

Bids are asked as follows by the paymaster-general, U. S. N., Chief of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing supplies: Until 10 a.m., May 7, Schedule 4469, Classes 21 to 25, for delivery at the navy yard, Philadelphia, the tungsten tool steel and carbon steel to be used by the navy department during the year ending June 30, 1913; until 10 a.m., May 14, Schedule 4493, Class 11, for delivery at the navy yard, Washington, D. C., one recoil cylinder (nickel steel), about 2633 lb.; Class 12, for delivery at the torpedo station, Newport, R. I., 6900 lb. hard-drawn torpedo bronze; Schedule 4496, Class 34, for delivery at the navy yard, Brooklyn, N. Y., 4310 lb. monel metal castings; Class 35, 15,000 lb. manganese bronze, for delivery at the navy yard, Portsmouth, N. H.; Class 36, for delivery at the navy yard, Puget Sound, Wash., 7500 lb. manganese bronze; Schedule 4499, for delivery at the navy yard, Philadelphia, Penn., Class 57, one pipe expanding and flanging machine, motor driven; Class 58, one six-roll double-cylinder planer and matcher, motor driven; Class 59, one centrifugal air compressor set, equipped with 230-volt, direct-current, direct-connected motor, capacity, 1900 cu.ft. per min. at pressure of 4 lb. per sq.in.; Schedule 4501, for delivery at the Brooklyn navy yard, Class 77, hexagon steel nuts and bolts; Class 78, rivets, steel, hull, pan head, straight necks; Class 79, screws, steel, wood, tinned, flat countersunk heads; Class 80, iron and brass machine screws; Class 81, brass wood screws; Class 82, dies for machine screws; Class 83, files; Class 84, 900 pipe wrenches, etc.

SOUTHERN STATES

The Virginia Ry. & Power Co., Norfolk, Va., will erect shops at Norfolk to include machine, repair, blacksmith and carpenter shops.

The Garage Co., Pulaski, Va., has awarded the contract to the Ward Brick Co., to erect an addition to its building.

The foundry of the Norfolk & Western Ry., Roanoke, Va., was damaged by fire, Apr. 13. Loss, $50,000, covered by insurance. N. L. Friese is general foreman of the car department.

The E. B. Lyon Motor Car Co., Durham, N. C., will erect a brick garage, show room and work shop to cost $50,000.

F. E. Block, Atlanta, Ga., will erect a one-story brick garage, at 40 North Ave., to cost $10,000.

The Locomobile Co. is erecting a new building for its Southern branch, at Merrits Ave. and Peachtree St., Atlanta, Ga.

The Georgian Mfg. Co., Rome, Ga., will build a large addition to its valve manufacturing plant.

The Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., will expend $50,000 for improvements, including hoist engine, two air compressors and 20 dwellings at Sloss iron-ore mines, the cost being $35,000; two air compressors and boilers for 400 hp. at Bessie coal mines.

The Louisville Ry. Co., Louisville, Ky., will erect a large shop for the repair and reconstruction of its cars, at Twenty-ninth St. and Broadway, Louisville. Helm Minary is in charge.

The Sutherland Automobile Air Appliance Co., 718 South Second St., Louisville, Ky., is equipping a machine shop to manufacture a patented automobile brake. Luke Sutherland is manager.

MIDDLE WEST

The Burgher Iron Co., Akron, Ohio, maker of structural iron and conveying machinery, will enlarge its plant.

A garage will be equipped by the Akron Cutting Car Co., Akron, Ohio.

The Standard Steel Co., Bedford, Ohio, is enlarging its plant for the production of polished steel sheets.

The Standard Steel Co., Bedford, Ohio, is enlarging its plant and installing additional equipment.

The Iron Clad Mantle Co., Sebring, Ohio, will remove its plant to Canton, Ohio.

The Berger Mfg. Co., Canton, Ohio, maker of pressed-steel ceilings and steel goods, will build a large addition to its plant. Noted Apr. 4.

The Canton Metal Ceiling Co., Canton, Ohio, incorporated for $200,000 by H. Briggle, L. V. Carnahan and others, to equip a plant to make metal ceilings.

The Robinson Mfg. Co., Cleveland, Ohio, will begin construction of a one-story building, 30x60 ft., and a smaller one, to manufacture pipe straps and pipe hangers.

The West Steel Casting Co., Cleveland, Ohio, will erect a new foundry, 52x70 ft.

The Jansen-Peterson Co., Cleveland, Ohio, has installed a plant, at 1688 Columbus road, for the manufacture of wood-working machinery, making a specialty of belt sanding machinery. W. C. Bruce is the president.

The Willard Storage Battery Co., Cleveland, Ohio, has moved to 5716 Euclid Ave., and will erect an extension to the present plant, which will afford 25,000 ft. additional space. Noted Apr. 18.

The Cleveland Metal Products Co., Ivanhoe Road, Cleveland, Ohio, has awarded a contract for the construction of a new factory. It will be of brick, one story high, 80x25 ft.

The Cleveland Bronze & Brass Co., Cleveland, Ohio, is building a new concrete factory.

The Grant Motor Car Co., Cleveland, Ohio, will equip a large garage.

The Ferro Foundry & Machine Co., Cleveland, Ohio, makers of "Ferro" gas engines, will build a new factory. Noted Mar. 14.

A machine shop will be built by J. Ord, at 3308 Broadway Ave., Cleveland, Ohio.

The Rummel Machine Screw Mfg. Co., Cleveland, Ohio, will build and equip an addition to its plant.

A garage will be built by P. N. Smit, at 9901 Parkgate Ave., Cleveland, Ohio.

M. L. Dauby, 11,204 Euclid Ave., Cleveland, Ohio, will build a garage.

The Unigraph Co., Cleveland, Ohio, has been incorporated by H. H. Weeden and others to equip a factory to manufacture printing machines and office devices.

A garage will be built by H. Steinbrenner, 1591 East 115th St., Cleveland, Ohio.

L. S. Steward has been awarded the contract for the construction of a factory building on North Fourth St., Columbus, Ohio, for the Columbus Auto Brass Co.

The Columbus Contractors' Supply Co. will erect a one-story factory, 150x150 ft., at Taylor's Station, Columbus, Ohio.

A complete new plant for the manufacture of well-drilling machinery will be built at Columbus, Ohio, by the American Well & Prospecting Co., Corsicana, Tex.

The Cincinnati, Hamilton & Dayton Ry. Co. will erect new locomotive shops, at Elmwood Place, near Cincinnati, Ohio.

The Daylight Burner Co., Cincinnati, Ohio, is incorporated to equip a factory to make a new gas burner. E. M. Kuhn and others are the incorporators.

The Norwood Machine Co., Cincinnati, Ohio, will erect a public brick garage, 63x110 ft., at the corner of Main and Madison Sts. Noted Mar. 21.

The Henkel Co., Fremont, Ohio, maker of razors, shears, etc., will erect a two-story and basement addition, 50x150 ft., to its plant.

The Mosler Safe Co., manufacturing safes and fireproof vaults, will build an addition to its present plant, at Hamilton, Ohio. Bert Baldwin is consulting engineer, Commercial Tribune Building, Cincinnati, Ohio.

The American Laundry Machinery Co. is adding to the mechanical equipment of its plant No. 2, Norwood, Ohio.

Work has begun on reconstructing the Oxford roller mill, Oxford, Ohio, which was destroyed by fire, April 10.

The Browning Steam Shovel Co. will erect a plant at Mansfield, Ohio.

The Commercial Steel Body Co., Sidney, Ohio, has been incorporated by P. F. Dyke, R. C. Hess and others, to equip a plant to manufacture steel automobile bodies.

The Toledo Machine & Tool Co., Toledo, Ohio, has awarded a contract for a three-story iron and brick building, 90x115 ft.

The Block Gas Mantle Co., Youngstown, Ohio, has been incorporated for $1,000,000 by C. H. Hine, L. A. Manchester and others, to equip a plant to make gas mantles. Power-plant equipment will be purchased.

The Mahoning & Shenango Ry. & Light Co., Youngstown, Ohio, is contemplating the construction of an extensive new car house, substation, freight station, and small machine shops.

The contract for the buildings of the new openhearth steel furnace of the Brier Hill Steel Co., Youngstown, Ohio, has been let to the American Bridge Co.

A garage will be equipped by the Central Garage Co., Xenia, Ohio.

The Nyberg Automobile Co., Anderson, Ind., will erect two factory buildings, at Meridian and Twelfth Sts.

R. B. Rayner, Fort Wayne, Ind., will remodel the premises at 605-7 Lafayette St. into a garage. Mr. Rayner has the agency for the Cutting car.

H. G. Raymond, agent for the R. C. H., Waverley electric and Imperial cars at Fort Wayne, Ind., is erecting a brick and stone garage and salesroom, with a floor space of 7680 sq.ft.

The Muncie Gear Co., Muncie, Ind., will remove its plant to Cincinnati, Ohio, as soon as suitable location can be secured.

The C. M. Hall Lamp Co., Detroit, Mich., manufacturer of auto lamps, is erecting a new brick factory, on Hancock Ave.

The Interchangeable Fixtures Co., Grand Rapids, Mich., is having plans prepared for a two-story factory, 60x100 ft., to cost $30,000. S. Fisher is the manager.

T. C. Hubbard will erect a one-story garage at 172 South Fuller St., Grand Rapids, Mich.

The Keeler Brass Works is erecting an addition to its plant at Grand Rapids, Mich.

R. T. White, Annawan, Ill., who has the agency for the E-M-F and Flanders automobiles, is building a fireproof garage.

The Urbana Auto Co. has commenced work on the addition to its garage, at Champaign, Ill. Noted Apr. 4.

Julius Bender, Chicago, Ill., will build a two-story brick garage, at 1303-7 Jackson Boulevard.

The Chicago Foundry Co. will build a one-story brick foundry, at 2023-7 North 57th St., Chicago, Ill.

Fire destroyed the factory of the American Cutlery Co., Chicago, Ill., at a loss of $3000.

The Missouri Malleable Iron Co., East St. Louis, Ill., has awarded all contracts for erection of buildings to cost about $35,000. F. E. Neilsen is the president. Noted Mar. 14.

G. A. DeLong, Foosland, Ill., is having plans prepared for a 45x100-ft. Danville faced brick garage.

Wolff Bros., Racine, Wis., will construct a plant for manufacturing metal pattern works, at Joliet, Ill.

The Wisconsin Motor Mfg. Co., West Allis, Wis., will erect an addition to its plant which will double its capacity. Charles John is general manager.

New machine-shop equipment will be bought for the new factory of the Harley-Davison Motor Co., Milwaukee, Wis. Noted Mar. 21.

The Manitowoc Brass Foundry Co., Manitowoc, Wis., will enlarge its plant.

The Termatt & Monohan Co., Oshkosh, Wis., will rebuild its foundry, recently destroyed by fire. Noted Apr. 25.

WEST OF THE MISSISSIPPI

H. C. Thayer, Davenport, Iowa, will construct a factory of cement for the manufacture of stoves, at Mankato, Minn.

The Shotthill Steel & Iron Co., Marshalltown, Iowa, will remove its general office to Des Moines. It has a capital of $300,000, and will build a plant at Perry, Iowa.

The contract for constructing machine shops and a warehouse for the Duluth Diamond Drill Co., Duluth, Minn., has been awarded.

The National Electric Lamp Co., Cleveland, Ohio, which also has a plant at St. Louis, Mo., will soon erect a factory at Minneapolis, Minn. A site covering four acres has been purchased. The estimated cost is $500,000.

The factory of the St. Louis Lightning Rod Co., De Kalb St., between North and South Trudeau Sts., St. Louis, Mo., was damaged by fire, Apr. 20, to the extent of $15,000. H. F. Kretzer is president.

The Barry-Wehmiller Machinery Co., St. Louis, Mo., will improve and enlarge its plant.

W. H. Leslie, Bishop, Tex., will erect a garage and machine shop to cost $15,000.

E. E. Evans, Houston, Tex., will erect a 50x120-ft. steel garage and machine shop on Ohio Ave.

The San Antonio, Rockport & Mexico R.R. Co. has acquired a site at Rockport, Tex., on which it will erect a roundhouse, car shops and other terminal facilities.

The Gulf, Colorado & Santa Fé Co. has awarded the contract for the construction of a new boiler house and blacksmith shop, at Temple, Tex.

WESTERN STATES

The Pacific Tin Plate Co., Seattle, Wash., will erect a plant at Youngstown, Wash., to manufacture tin plates, cans and miscellaneous articles of tinware. The estimated cost is $3,000,000.

The Oregon Fruit Cleaner Co. will establish a factory at The Dalles, Ore., to manufacture machinery for cleaning and grading fruit. O. K. Porter and J. A. Reuter are interested.

The Coast Culvert & Flume Co., 240 East Seventh St., Portland, Ore., will erect a machine shop and manufacturing plant on the Columbia Boulevard, at Kenton, near Portland.

H. J. Kimball, Portland, Ore., is contemplating the erection of a machine shop on North Front St., Marshfield, Ore.

The Operative Motor Co., Long Beach, Calif., which has been recently incorporated with a capital of $150,000, contemplates the erection of a commercial garage and repair plant to cost about $60,000.

Alvin L. Eagles, Los Angeles, Calif., will erect a commercial garage and machine shop on Union Ave.

CANADA

Fire caused $1200 damage to the building of the Gareau Motor Car Co., Lariviere Lane, Montreal, Que.

The Warren Axe & Tool Co., Warren, Penn., which has been recently incorporated, will build a factory at St. Catherine, Ont. The estimated cost is $40,000.

A plant for the manufacture of lathes and tools will be erected at Galt, Ont., for William Preston.

The Canadian Pacific Ry. has awarded the contract for the erection of new shops near Calgary, Alta., to cost $2,500,000. The plant will include a main locomotive shop, 305x312 ft., comprising machine, blacksmith and boiler shops; a foundry building, 80x204 ft., pattern shop, 30x100 ft., freight-car repair shop, 230x300 ft., coach-repair and paint shop, 146x360 ft., planing mill, 80x300 ft., and a power plant. Each building will be equipped with every modern appliance; electric traveling cranes, jib cranes and transfer tables will be installed. Noted Feb. 22.

New Incorporations

METAL WORKING

The following companies have been incorporated to manufacture:

The Commonwealth Last Co., Kittery, Maine; appliances and machinery used in shoemaking. Capital, $20,000. Incorporators: Horace Mitchell and C. E. Smothers.

American Float Electric Co., Boston, Mass.; electric lamps. Capital, $600,000. Incorporators: Joseph J. Horsfall and Robert M. Currier, 79 Milk St., Boston, and George B. Crafts, Jamaica Plain.

Boston & Lockport Block Co., Boston, Mass.; pulley blocks. Capital, $300,000. Incorporators: A. D. Bosson, Chelsea, and M. H. Tarbox, Newton.

The Progress Mfg. Co., Boston, Mass.; embossing presses. Capital, $50,000. L. S. Riley is president and T. F. Kimball, treasurer.

The Franklin Plate Co., Greenfield, Mass.; cutlery. Capital $30,000. G. C. Hunt is president.

The Twisted Wire & Steel Co., Manhattan, N. Y.; wire and articles of metal wire. Capital, $95,000. Incorporators: J. S. Klotz, A. Feldblum and P. Leirson, Brooklyn.

The Mitchell Edmonston Garage, Inc., Manhattan, N. Y. Capital, $10,000. Incorporators: Liland A. Mitchell, 9 Ft. Washington Ave., New York, N. Y.; George W. Edmonston, 460 Bloomfield Ave., Montclair, N. J., and Joseph P. Bickerton, Jr., 104 West Seventieth St., New York.

The Century Oil Engine Co., Bay Shore, N. Y.; machinery. Capital, $50,000. Incorporators, B. D. Powleson, K. Harman and F. B. Crosby, New York, N. Y.

The Crowell Manufacturing Co., Brooklyn, N. Y.; machinery and tools. Capital, $25,000. Incorporators: W. Shaw, W. E. Cook and I. Roberts.

Thomas Paulson & Son, Inc., Brooklyn, N. Y.; general brass foundry. Capital, $30,000. Incorporators: Thomas Paulson and Mary Paulson, 161 Prospect Park, and William Paulson, 434 East Fifth St., Brooklyn.

The South Buffalo Garage, Inc., Buffalo, N. Y.; garage. Capital, $10,000. Incorporators: William F. Coatsworth, Mary L. Coatsworth and Leon R. Jenkins, all of Buffalo, N. Y.

The Buffalo Automatic Sales Co., Buffalo, N. Y.; vending machines. Capital, $10,000. Incorporators: Walter F. Titus, Charles A. Poppert and Percival G. Bixby.

The Eastman Mfg. Co., Manhattan, N. Y.; cutlery and tools. Capital, $100,000. Incorporators: D. Eastman, New York, N. Y.; R. S. Sutherland, White Plains, and G. Bemoit, Brooklyn.

The Houpert Machine Co., Manhattan, N. Y.; motors, engines and machinery. Capital, $25,000. Incorporators: H. J. Houpert, Mamaroneck, N. Y.; N. W. Durnin, Bronx, and S. Carousso, New York, N. Y.

The Consolidated Drink Vending Co., Inc., Manhattan, N. Y.; slot machines for vending beverages. Capital, $100,000. Incorporators: L. G. Murnin, S. Rosenfeld and J. C. Zimmerman, New York, N. Y.

The Hoevel Sand Blast Machine Co., Manhattan, N. Y.; sand-blast machinery. Capital, $10,000. Incorporators: Felix F. Wiener, Herman F. Hoevel and Ernest G. Schnaisser, 50 Church St., New York, N. Y.

The Stafford Machine Co., Manhattan, N. Y.; machines and patented devices. Capital, $50,000. Incorporators: N. Stafford, L. G. Stafford and C. C. Beekman, New York, N. Y.

The Motorflex Equipment Co., Manhattan, N. Y.; machinery. Capital, $150,000. Incorporators: S. J. Prescott, Brooklyn; C. B. Goldsborough, New Rochelle, and D. H. Haynes, New York, N. Y.

The Child & Scott Co., Manhattan, N. Y.; steam power, heating and ventilating apparatus. Capital, $40,000. Incorporators: E. T. Child, G. M. Scott and J. E. Jeffrey, New York, N. Y.

The King Fire Signal Co., Millbrook, N. Y.; fire-alarm devices. Capital, $500,000. Incorporators: W. J. Hildebrandt, Brooklyn; J. K. Aldrich and G. F. Johnson, New York, N. Y.

The Phillips Manufacturing Co., New York, N. Y.; electrical supplies. Capital, $15,000. Incorporators: William A. Thompson, Jr., 17 Battery Place, Thomas E. Chappell, 60 Wall St., New York, N. Y., and William J. Lowrie, 661 East Eighteenth St., Brooklyn, N. Y.

Halbert P. Hill, Inc., New York, N. Y.; electrical machinery. Capital, $50,000. Incorporators: H. P. Hill, M. W. Atkinson and A. M. Heritage, New York, N. Y.

The Extensive Manufacturing Co., New York, N. Y.; vending machines and mechanical and electrical devices. Capital, $150,000. Incorporators: T. G. Jenkins, P. E. Seib and A. F. Bucher, New York, N. Y.

The "E. D." Gear Co., New York, N. Y.; machinery. Capital, $60,000. Incorporators: D. J. Rice, J. P. Eadie and G. Keating, New York, N. Y.

The Perfect Safety Razor Co., New York, N. Y.; razors and cutlery. Capital, $50,000. Incorporators: M. Hauser, Richmond Hill, N. Y.; L. M. Fisher, New York, N. Y., and F. W. Krahe, Brooklyn, N. Y.

The Interstate Electric Novelty Co., New York, N. Y.; machinery, appliances and electric supplies. Capital, $130,000. Incorporators, A. Wolff, New York, N. Y., and S. I. Posen and M. L. Kaplan, Brooklyn, N. Y.

The Combination Transmission Clutch Co., New York, N. Y.; machinery. Capital, $10,000. Incorporators: Louis E. Bomeisler, George Sakson and Herman Gustow, 235 Broadway, New York.

The Hardware & Supply Co., New York, N. Y. Capital, $10,000. Incorporators, George K. Herr, 318 First St., Herman A. Sanders, 584 Kosciusko St., Walter L. Vogts, 76 Rutland Rd., Brooklyn.

The Oneida Foundry Co., Oneida, N. Y.; metal casting and machinery. Capital, $25,000. Incorporators, H. R. Willi, G. D. Gingrich, Williamsport, Penn., and R. M. Gingrich, Oneida.

The American Teletype Co., Wyandance, N. Y.; machinery for communication. Capital, $10,000. Incorporators: John McLaren, E. J. Forhan and F. B. Knowlton, all of 154 Nassau St., New York, N. Y.

The W. C. Akins Machine Co., Rochester, N. Y.; machines. Capital, $10,000. Incorporators: Arthur Warren, William C. Akins and Elizabeth G. Akins.

The Trojan Machinery Co., Troy, N. Y.; machinery and tools. Capital, $1000. Incorporators: William H. Tolhurst, Pittsfield, Mass.; Clark H. Foster and Charles H. Aldrich, Troy.

The Russ & Krekel Co., White Plains, N. Y.; stoves, radiators, boilers and grates. Capital, $25,000. Incorporators: G. S. Russ, Yonkers; C. L. Krekel and C. S. Ashley, New York, N. Y.

The Penn Type Foundry, Camden, N. J.; type and printers' supplies. Capital, $30,000. Incorporators, W. J. McKee, Camden; G. A. Flaith, Philadelphia, Penn., and J. A. Campbell, Brooklyn, N. Y.

The Phoenix Supply & Manufacturing Co., Camden, N. J., textile machinery. Capital, $125,000. Incorporators, M. B. Webster, H. N Heulinge and J. C. Haines, Camden.

The Kadix Newark Motor Truck Co., East Orange, N. J.; motor trucks. Capital, $200,000. Incorporators, G. F. Kallberg, L. L. Dann, East Orange, and R. M. Colborn, Newark, N. J.

The Keystone National Electric Co., Hoboken, N. J.; incandescent lamps, electrical apparatus and machinery. Capital, $600,000. Incorporators, D. F. Plahn, Hoboken; C. W. Shaffer and R. K. Mickey, New York, N. Y.

The National Gas Steam Heating Co., Passaic, N. J.; gas radiating heaters. Capital, $250,000. Incorporators: W. H. Geissler, New York, N. Y.; J. A. Troast and J. H. Mayes, Passaic.

The Trenton Electric & Conduit Co., Trenton, N. J.; electrical supplies, metallic and porcelain conduits and switchboards. Capital, $25,000. Incorporators, L. Alpaugh, C. J. Alpaugh and E. A. Alpaugh, Trenton.

The Elastic Wheel Co., Baltimore, Md.; automobiles and other motor vehicles. Capital, $1,000,000. Incorporators: Schuyler C. Hatfield and George W. Smith, Baltimore, and Isaac Fogg, Wilmington, Del.

The Vendome Copper & Brass Works, Louisville, Ky. Capital, $10,000. Incorporators: Elmore Sherman, Charles J. Thoben and Lula E. Sherman.

The B-M-O Motor Truck Co., Cleveland, Ohio; automobiles and sundries. Capital, $5000. Incorporators, R. A. Wilbur, A. S. Dole, M. H. Coyne, C. C. Wise and C. S. Wachner.

The Browning Steam Shovel Co., Cleveland, Ohio; steam shovels and machinery. Capital, $125,000. Incorporators, M. M. Feidner, C. R. Dietz, O. A. Sykora, John F. Wilson and William B. Woods.

The Wood & Spencer Engineering Co., Cleveland, Ohio; electrical, gas, gasoline and steam or other plants for lighting and power producing purposes. Capital, $50,000. Incorporators: A. E. Harrold, E. J. Edwards and W. H. Marlatt.

The Hampton Mfg. Co., Indianapolis, Ind.; automobile accessories. Capital, $5000. Incorporators, S. B. Nussmaum, Sol Allman and William Hampton.

The Indianapolis Metal Products Co., Indianapolis, Ind., has been incorporated, with a capital of $30,000, to manufacture castings. The incorporators are Frank Thompson, Ivan Ellis and L. B. Sulgrove.

The National Aluminum & Bronze Manufacturing Co., Indianapolis, Ind., has been incorporated, with a capital of $10,000, to operate a foundry and machine shop. The incorporators are H. Hunt, E. Davis and H. J. Weiler.

The Commercial Steel Body Co., Sidney, Ohio; general metal products. Capital, $25,000. Incorporators: P. P. Dyke, William Vossler and W. A. Burket.

The Vixen Motor Co., Indianapolis, Ind. Capital, $12,000. Incorporators: F. C. Schmid, W. J. Harris and C. O. Van Horn.

The Warner Vacuum Cleaner Co., Muncie, Ind. Capital, $10,000. Incorporators: J. F. Warner, Henry Warner and J. F. Kiser.

Traction Appliance Co., Vincennes, Ind.; electric and gasoline motors. Capital, $3500. Incorporators: F. C. Morgan, G. E. Henry and J. J. Risch.

The Chromo Silver Bronze Co., Chicago, Ill.; metals, alloys and amalgamation. Capital, $10,000. Incorporators: Harvey J. Hay, H. Fitzgerald and E. C. Koskoba.

The Carl Boensch Mfg. Co., Chicago, Ill.; electrical fixtures. Capital, $2500. Incorporators: Carl Boensch, Walter L. Jensen and Frieda Getz.

The Mid-West Auto Supply Co., Chicago, Ill.; automobile supplies. Capital, $50,000. Incorporators: S. G. Camp, Clarence Joseph and B. H. Rifenbark.

The McFarland-Hyde Co., Chicago, Ill.; sheet-metal work. Capital, $100,000. Incorporators, J. C. McFarland, E. N. Hyde and R. W. Beach.

The Leap Resilient Wheel Co., Chicago, Ill.; machinery. Capital, $300,000. Incorporators: H. T. Howard, T. Pomeroy and E. H. Cassels, Chicago.

The United States Bottlers' Machinery Co., Chicago, Ill., has been incorporated, with a capital of $25,000, to manufacture. The incorporators are Edwin M. Ashcraft, Edwin M. Ashcraft, Jr., and Charles F. Rathbun.

The Motor Sales Co., Chicago, Ill., has been incorporated, with a capital of $10,000, to manufacture motors and engines. The incorporators are Irwin N. Walker, Frederic L. Goff and M. M. Miller.

The Simplex Refrigerating Machine Co., Chicago, Ill., ice machines. Capital, $200,000. Incorporators, Swan Borglund, John A. Olson and Sven O. Hawkinson.

The United Bottlers' Machinery Co., Chicago, Ill. Capital, $25,000. Incorporators, Edwin M. Ashcroft, Edwin M. Ashcroft, Jr., and Charles F. Rathbun.

The Paine Co., Glen Ellyn, Ill.; machinery. Capital, $5000. Incorporators, F. W. Hill, H. B. Beck and E. T. Goodrich.

The North Dakota Gas Engine Manufacturing Co., Lansford, N. D. Capital, $25,000. Incorporators, William Dammann, O. C. Mueller and J. Berg.

The Kingston Aërial Co., Kingston, Okla.; flying machines. Capital, $25,000. Incorporators: W. Thompson, W. A. Williams and B. B. Steel.

The International Manufacturing & Sales Co., Oklahoma City, Okla.; heating appliances. Capital, $100,000. Incorporators, J. F. Smith, C. R. Stanton and V. H. Vallery, all of Oklahoma City.

The Canadian Fuel Savers' Co., Ltd., Berlin, Ont.; furnaces. Capital, $40,000. Incorporators: Dilman S. Bowman, Beniah Bowman and Myron Bowman.

General Manufacturing

NEW ENGLAND

The Barnjum Timberland Co., Augusta, Maine, will erect several lumber mills.

The Lincoln County Lumber Co. will erect a box and shook factory, at Bath, Maine.

Work has begun on the construction of a pulp mill at Shawmut, Maine, for the Shawmut Mfg. Co. Estimated cost, $2,000,000.

The plant of the New England Brick Co., near Fremont, N. H., was damaged by fire, Apr. 21. Loss, $2000.

The F. M. Hoyt Shoe Co., Manchester, N. H., will erect an addition to its factory to cost about $20,000. J. Edward Baker is the architect.

The Leather Board Co., Milton, N. H., will rebuild its plant recently destroyed by fire. Noted Mar. 28.

The plant of the St. Albans Granite Co., St. Albans, Vt., was destroyed by fire, Apr. 23. Loss, $25,000, covered by insurance.

The D. B. Granite Co., East Barre, Vt., will rebuild its plant recently destroyed by fire. Noted Mar. 14.

The city of Boston, Mass., will install a pumping plant at the Riverside gatehouse.

The city of Fall River will improve its water system.

The D. M. Dillon Steam Boiler Works, Fitchburg, Mass., will erect a new boiler house on Crocker St.

The contract has been awarded for the erection of a new mill on North Winter St., Holyoke, Mass., for the Japanese Tissue Mills Co.

The Merrick Lumber Co., Holyoke, Mass., will build a new mill.

The American Thread Co., Holyoke, Mass., contemplates the erection of a plant on Canal and Bridge Sts.

Patrick Garvan, Inc., will erect a four-story paper mill on Bridge St., Holyoke, Mass.

The Merrimack Utilization Co., Warren St., Lowell, Mass., is planning to erect an additional mill to its plant.

The Leominster Novelty Co., Leominster, Mass., manufacturer of wooden novelties, will erect a new plant to cost $10,000, to replace the one recently destroyed by fire.

Edmond Poliquin and Grandville J. Houle, of Boston, Mass., will build a shoe factory near Lunds Corner, New Bedford, Mass., to cost about $50,000.

The Eaton, Crane & Pike Paper Co., Pittsfield, Mass., will construct an addition to its mill.

The New England Cotton Yarn Co., Taunton, Mass., will erect an addition, 200x150 ft.

J. S. Mason, operating a plant at Westboro, Mass., for the manufacture of cotton, mercerized and silk ribbons and webs and tapes, will erect a large mill. A tract of land has been selected and a mill having a capacity of over 100 looms will be built. It will be operated by electricity. An addition to the present plant is about completed and will soon be occupied.

The Sherman Envelope Co., Worcester, Mass., is considering the erection of additions to its plant on Prescott St.

The hat factory of Hawes, Von Gal, Danbury, Conn., was damaged by fire, Apr. 21. Loss, $15,000.

The W. E. Cairns Woodworking Co., Hartford, Conn., whose plant was recently destroyed by fire, will rebuild. The new building will be of brick, 60x70 ft. Noted Apr. 25.

The city of Hartford, Conn., has voted $50,000 of bonds for the installation of a new pumping station.

H. Hall & Co., New Haven, Conn., manufacturers of organs, will erect a new factory.

The Strong, Barnes & Hart Co., New Haven, Conn., will erect a cold-storage building on Long Wharf. It will be 32x64 ft.

The contract for the addition to the electric-light plant of Wallingford, Conn., has been awarded. Cost, $3000.

MIDDLE ATLANTIC STATES

The plant of the Weaver Naylor Tar Roofing Co., 140-146 Candler St., Buffalo, N. Y., was damaged by fire, Apr. 21. Loss, $2500.

The city will erect a power house and laundry building, in connection with the proposed city hospital. Francis G. Ward is commissioner of public works.

A grain elevator at Pacific St. and the East River, Brooklyn, N. Y., owned by the New York Dock Co., was destroyed by fire, Apr. 22. Los, $75,000, covered by insurance.

The building at 1199-1201 Atlantic Ave., Brooklyn, N. Y., was damaged by fire, Apr. 22. The building was occupied by David Seigler, confectioner, and George Hilliard, manufacturer of paper boxes. Loss, $17,000.

The Sodus Gas & Electric Co. is preparing to construct an electric-light plant at Cohocton, N. Y. C. D. Mills, Sodus, N. Y., is general manager.

The Union Mills, manufacturers of knit goods, Hudson, N. Y., are having plans prepared for a four-story and basement addition, 60x150 ft., to their mill at Catskill, N. Y., and for a two-story and basement addition, 16x253 ft., at St. Johnsville, N. Y. J. Reaney is president.

Work was started, Apr. 15, for the erection of a soap factory, at Mariners Harbor (S. I.), N. Y., for the Procter & Gamble Co.

The Minetto-Meriden Co., Minetto, N. Y., has commenced the erection of a $50,000 power plant. Next year the company contemplates spending $225,000 for the erection of a hydraulic power plant. Noted Apr. 11.

The factory of the Niagara Sprayer Co., on Elizabeth St., Middleport, N. Y., was damaged by fire, Apr. 16. Loss, $2000.

The Meerschaum Co. of America, which has been reorganized with a capital of $100,000, will at once equip and operate its plant, at Ogdensburg, N. Y.

The Regal Paper Co., Pulaski, N. Y., has purchased from Peach & Salisbury, its one-story, 140x40-ft. plant, and also a large ice house, near the plant. New machinery is to be installed for the manufacture of paper.

The Crescent Bread Co., Utica, N. Y., has awarded the contract for a bakery plant, 63x99 ft., three stories and basement, at 57 Jay St. Estimated cost, $26,000. R. E. Auld is president.

The Superior Ivory Button Co., Newark, N. J., has had plans prepared for a plant to consist of a main building, 50x150 ft., four stories, with an ell, 42x63 ft., one story. Estimated cost, with equipment, is $50,000.

The city of Newark, N. J., will build a new fire station, 48x114 ft., expending $50,000, with a machine-shop equipment.

The James Kerr dyeing and cleaning plant, Philadelphia, Penn., was destroyed by fire. Loss, $10,000.

The plant of Stuart Bros., stationers, printers and bank-book manufacturers, Ninth St. and Columbia Ave., Philadelphia, Penn., was destroyed by fire. Loss, $100,000.

A plant will be erected at 12th and Wood Sts., Philadelphia, Penn., by J. Edwards & Co., shoe manufacturers. The building will be ten stories, of concrete.

The Atlantic Product Co., 2046 Chestnut St., Philadelphia, Penn., has awarded the contract for the digester building at the plant at Atlantic City, N. J. The building will be of reinforced concrete and steel, one story, 65x97 ft. W. H. Gibson, Harrison Building, Philadelphia, is the architect and engineer. Work will be started at once.

The Southern Cotton Oil Co., Bayonne, N. J., will erect an addition to its plant. The capacity of the power plant will also be increased.

The National Carbon Co., Madison Ave., N. W., and West One Hundred and Seventeenth St., Cleveland, Ohio, has purchased a site in Jersey City, N. J., upon which to erect a plant.

Weingarten Bros., Newark, N. J., corset makers, will erect a five-story brick factory on Summit Ave.

The Borlacher Bottling Co. will build an addition to its plant, on Bridge St., Allentown, Penn. Estimated cost, $6000.

Becker Bros. Co., overall manufacturer, Tonawanda, N. Y., will remove to Butler, Penn., where the company will enlarge its main plant.

The Gettysburg Furniture Co., Gettysburg, Penn., has started work on its new factory building for the manufacture of china closets.

The Swift Beef Co. is erecting an addition to its beef house, at Lehighton, Penn. Estimated cost, $6000.

The Romberger Hosiery Mill, Middletown, Penn., is considering the erection of a large addition on Pine St.

The Wm. Steele & Son Co. is erecting a new plant for the Dill & Collins Co., paper manufacturers, on Schiller St., Philadelphia, Penn. The cost will be $20,000.

The plant of Stuart Bros. & Co., printers and stationers, Columbia Ave. and Ninth St., Philadelphia, Penn., was destroyed by fire, Apr. 22. Loss, $100,000.

The contract for the erection of a one-story power house at Twenty-second St. and Washington Ave., for John Wanamaker, Philadelphia, Penn., has been awarded.

The General Electric Co., Philadelphia, Penn., is receiving estimates for the erection of several additions to its power house on Christian St.

The plant of the Waverly Oil Co., Fifty-fourth and Butler Sts., Pittsburg, Penn., was damaged by fire, Apr. 15. Loss, $12,000.

The contract for the reconstruction of the concrete pudding kitchen and engine room of William Zoller So., pork packers, 359 Spring Garden Ave., Pittsburg, Penn., recently damaged by fire, has been awarded. The cost will be about $35,000.

The Quaker City Rubber Co., Philadelphia, Penn., has let a contract for a one-story power house, at Milnor and Comly Sts.

Taubel Bros., Philadelphia, Penn., manufacturers of hosiery, have let a contract for a two-story dyehouse as an addition to their plant, at Cedar and Huntingdon Sts.

The contract for erecting a plant for the Penn Planing Mill, on Second and Grape Sts., Reading, Penn., has been awarded. The estimated cost is $25,000.

The confectionery plant of the Frederick W. Lipps Co., Calverton Road and Hollins St., Baltimore, Md., will be enlarged.

The John J. Boyle Co., Wolfe and Thames Sts., Baltimore, Md., has awarded the contract for the construction of a two-story canning factory and storage plant, 155x240 ft., of brick and concrete construction.

The Baltimore & Ohio R.R. Co. will erect an electrical substation at the Mount Clare yards, Baltimore, Md., to cost $35,000.

O. G. Simonson, architect, is preparing plans for the erection of a six-story factory for McCawley Bros., Lombard St., Baltimore, Md., makers of overalls and working shirts. The structure will be located at Exchange Place and Commerce St.

SOUTHERN STATES

The grist mill of Cato & Lifsey, Emporia, Va., was destroyed by fire, Apr. 15. Loss, $2000, partly covered by insurance.

The Piedmont Manganese Corporation, Lynchburg, Va., will erect a large plant.

The Richmond Cotton Oil Co., Richmond, Va., will rebuild its refinery recently burned at a loss of $2000.

The Mayo Barrel Co., Richmond, Va., will rebuild its plant recently burned at a loss of $8000.

The Riverside & Dan River Cotton Mills will invest $1,500,000 for additional buildings and machinery, to manufacture cotton goods at Schoolfield, Va. R. A. Schoolfield is the president.

The Graham Mattress Co., Bluefield, W. Va., has been damaged by fire to an extent of $10,000.

O. A. Metcalf, Bluefield, W. Va., will rebuild his mattress factory recently destroyed by fire, at a loss of $4500.

The Asheville Timber Co., Asheville, N. C., will erect a band-saw and stove mill, and will requrie $20,000 worth of machinery.

The Hope Mills Mfg. Co., Charlotte, N. C., has increased its capital to $150,000. Improvements will be made.

The E. A. Smith Mfg. Co., Charlotte, N. C., has awarded a contract for a new mill at Rhodhiss, N. C. The main mill will be 275x104 ft., three stories, of reinforced concrete, and adjoining will be one story.

The Champion Fiber Co., Canton, N. C., plans to construct an electro-chemical plant, to cost $750,000.

The Durham Hosiery Co., Durham, N. C., will enlarge and improve its five mills. About $200,000 will be expended. Noted Apr. 4.

C. D. Roberts, Greensboro, N. C., is considering constructing a plant to manufacture shuttle blocks for cotton-mill shuttles.

The plant of the Virginia-Carolina Fertilizing Co., James City, N. C., was destroyed by fire, Apr. 19. Loss, $90,000, partly covered by insurance.

The American Hosiery Mills, Kernersville, N. C., was destroyed by fire, causing a loss of $100,000.

J. W. Cannon, head of the Cannon system of cotton mills in the Piedmont section of North Carolina, will take over the plant of the Bar Ridge Mfg. Co., at Rockwell, N. C., and increase its capacity.

The Peele Peanut Co., Roxobel, N. C., contemplates establishing a large potato cannery.

The Troy Milling Co., Troy, N. C., will erect additions to its mills. About $8000 worth of flour and feed machinery will be required. J. W. Lemonds is the manager. Noted Apr. 25.

The Virginia-Carolina Chemical Co., Wadesboro, N. C., has awarded a contract to build an addition to its fertilizer plant at a cost of $80,000.

The Dover Lumber Co., Richmond, Va., will erect a band sawmill at Waynesville, N. C.

The P. H. Hanes Knitting Co. is to erect an addition to its dyehouse at Winston-Salem, N. C.

The Columbia Laundry Co., Columbia, S. C., will erect a laundry, 50x125 ft.

The British-American Tobacco Co. is erecting a large brick factory at Charleston, S. C.

Henry A. Tisdale, Summerton, S. C., will rebuild his cotton gin recently burned at a loss of $3000.

W. H. Camp and L. G. Neal, Atlanta, Ga., will erect a cottonseed-oil mill and fertilizer plant, to cost $200,000.

The plant of the Industrial Lumber Co., Augusta, Ga., which was destroyed by fire, will be rebuilt.

Columbus, Ga., will expend $450,000 to construct water-works. A pumping station and reservoir will be constructed.

The Newson-Coleman Co., Hawkinsville, Ga., manufacturer of dry goods, was damaged by fire to the extent of $15,000.

C. I. Shelton, Indianola, Ga., will rebuild his sawmill recently destroyed by fire.

The Atlantic Compress Co. will erect a $50,000 cotton compress, at Millen, Ga.

The Vidalia Compress & Power Co., Vidalia, Ga., will erect a cotton compress.

The Southern Fertilizer Co., Orlando, Fla., has awarded the contract to D. J. Dykes to repair damages to burned building; new upper story and roof, 50x 105 ft., mill construction, to cost $2500.

The J. R. Jeffords & Co. will erect a packing plant at Pinellas, Fla.

J. G. Johnston, Bessemer, Ala., will build a concrete-block factory, 100x125 ft.

The Alabama Utahnite Co., Birmingham, Ala., will establish a plant to manufacture explosives; Crawford Johnson is the president.

Otto J. Zipperer will establish a broom factory at Foley, Ala.

Crystal Springs, Miss., will issue $10,000 for improvements to its electric-light plant and water works.

The Delta Laundry Co., Greenwood, Miss., will erect a laundry, 40x110 ft.

A new hydro-electric power plant is being built at Hale's Bar, near Chattanooga, Tenn., by the Chattanooga-Tennessee River Power Co.

Fire has damaged the plant of the Consignee's Favorite Box Co., Chattanooga, Tenn.

The Key-James Brick Co., Chattanooga, Tenn., has awarded contracts for its brick plant.

James L. Nicholson, Henderson, Tenn., has completed plans for the construction of a cold-storage plant which will cost $60,000.

The National Biscuit Co., Memphis, Tenn., will improve its plant.

The Campbellsville Lumber Co., Campbellsville, Ky., is enlarging its factory. Two buildings are being erected. Woodworking machinery will be needed.

The stirrup and handle factory of Henry F. Oliver, Fulton, Ky., was damaged by fire, Apr. 16. Loss, $25,000; insurance, $20,000.

The city of Falmouth, Ky., has awarded contracts for the construction of its electric-light plant.

James L. Nicholson, Henderson, Ky., will build a large cold-storage plant to cost $60,000.

The Louisville Cooperage Co., Louisville, Ky., will erect a building to be used for finishing staves. Planers, cut-off saws and other wood-working equipment will be installed. Nick White is the president.

The Ox Breeches Co., 835 West Main St., Louisville, Ky., will double the capacity of its clothing factory, and motors and special machinery will be needed. Charles New is the president.

The Frederick-Ruggles Co., 210 West Main St., Louisville, Ky., is contemplating the enlargement of its plant for manufacturing devices for measuring fluids.

Shymanski & Sons, Louisville, Ky., clothing manufacturers, will increase the capacity of their plant, and will be in the market for additional machinery.

C. F. Rood, Winchester, Ky., will erect a box factory, which will be operated in connection with a sawmill.

MIDDLE WEST

The Diamond Rubber Co., Akron, Ohio, maker of auto tires, will make improvements to its plant. Noted Apr. 4.

The Akron Sewage & Garbage Power Co., Akron, Ohio, will buy some power-plant equipment. C. D. Crouch is the manager.

The Winchester Handle Co., Bellevue, Ohio, has let the contract for the erection of a two-story factory.

Power equipment will be bought for factory by E. E. Meischner, Cleveland, Ohio.

The Case Fish Co., Cleveland, Ohio, will build a new fish-handling plant.

The Safety Fire & Gas Appliances Co., Cleveland, Ohio, has been incorporated, with a capital stock of $15,000, by O. P. McIlrath and others. The company is planning to erect a manufacturing plant.

A three-story factory building, costing $40,000, will be erected by the Mayer Realty Co., Cleveland, Ohio. It will be occupied by the Ideal Paper Box Co.

The Brooks Oil Co., Cleveland, Ohio, will add to its present oil-refining plant.

The Schneider-Becker Dairy Co., Cleveland, Ohio, will buy some butter and cheese making machinery.

The Big Four Milling Co., Cleveland, Ohio, incorporated by J. S. Crow and others, to build and equip a large flour mill.

Contract for the erection of the new plant for the Herschede Hall Clock Co., at McMillan St. and Essex Pl., Cincinnati, Ohio, has been let.

The Ohio Knife Co., Ninth and McLean Aves., Cincinnati, Ohio, will build a new manufacturing plant.

M. Werk & Co., Cincinnati, Ohio, will build two factory buildings, 94x370 ft., and 94x314 ft., to cost $250,000. Noted Apr. 4.

Fire destroyed the plant of the C. & E. Shoe Co., Columbus, Ohio, at a loss of about $500,000.

The John W. Brown Mfg. Co., Columbus, Ohio, has let the contract to erect an addition to its carriage lamp factory.

W. H. Beckett has started work remodelling the factory building for the Columbus Marble Co., on West Rich St., Columbus, Ohio, at a cost of $2000.

Plans have been completed and bids are being received by Richards, McCarty & Bulford, Columbus, Ohio, for the construction of a factory for the E. Edwin Smith Shoe Co. The building will be an eight-story reinforced-concrete structure, 188x94 ft.

Work has been begun on a new boiler and power house for the mills of the Sterling Paper Co., Hamilton, Ohio. Cullen & Vaughn are the contractors, Hamilton, Ohio.

The Lisbon Lime Co., Hephner Hollow Road, Lisbon, Ohio, is erecting new buildings.

The flour mill of Bert Esley, at Oxford, Ohio, was destroyed by fire, Apr. 9. Loss, $15,000; insurance, $11,000.

The National Plaster Board Co., Sandusky, Ohio, is having plans prepared for a two-story brick factory, 48x200 ft.

The Dolphin Hosiery Co., Jackson and St. Clair Sts., Toledo, Ohio, is planning the erection of a new factory. F. G. Gould is president.

The Buckey Paper Co., Toledo, Ohio, will need power-plant equipment for new factory to make paper products, brushes and woodenware. G. J. Merickel is the manager.

The North Terre Haute Canning Co., Brazil, Ind., is erecting a plant at Ellsworth, Ind.

The Uhl-Snyder Milling Co., flour manufacturers, Connersville, Ind., will install an entire new set of machinery, to cost about $10,000.

The Danville Canning Co., Danville, Ind., has been incorporated, with $50,000 capital, to construct and equip a canning factory. J. W. Trotter is interested.

The Luigs Butter Co., Evansville, Md., will spend $15,000 for improvements to its plant. A two-story storage plant will be erected.

Hilgemeier & Bro., Indianapolis, Ind., will build a modern meat-packing plant, at Daisy & Raymond Sts., to cost $20,000.

The Williams Food Products Co. is erecting a factory building, at Paoli, Ind., to cost about $27,000.

Adolph Leimgruber will erect a brick and concrete plant for the manufacture of artificial ice, in Shelby County, Ind. The plant will have a capacity of 15 tons daily.

Monroe & Learman, engineers, 512 Phoenix Bldg., Bay City, Mich., are preparing plans for a new chicle plant, to be located in Bad Axe, Mich. It will be of reinforced concrete. The cost is estimated at $40,000.

The Kindel Bed Co., Chicago, Ill., will erect a factory at Madison Square, Grand Rapids, Mich.

The Brunswick-Balke-Collender Co., manufacturer of billiard balls, cues, etc., will increase the capacity of its factory at Marquette, Mich.

The sawmill of the O'Callahan Lumber Co., Sturgeon River, Mich., was destroyed by fire, Apr. 19. Loss, $30,000, partly covered by insurance.

The Cant Hook Factory, South Boardman, Mich., recently destroyed by fire, will be rebuilt, at an estimated cost of $40,000. C. A. and M. E. Wellman are the owners.

E. C. Ellis will build a two-story brick laundry, at 5921-35 Lowe Ave., Chicago, Ill., and will equip it with new machinery.

The power house of the Illinois Steel Co., South Chicago, Ill., has been wrecked by an explosion. Loss, $100,000.

Fire destroyed the five-story pickle factory of the H. J. Heinz Co., Chicago, Ill., at a loss of about $400,000.

The Cereal Food Co. will erect a large building at the corner of Chestnut and Water Sts., Peoria, Ill.

The plant and two warehouses of the Burlington Blanket Co., Burlington, Wis., were destroyed by fire, Apr. 15. Loss, $100,000, covered by insurance.

The Algoma Produce Co. will erect a cold-storage plant, at Gillett, Wis.

The Doty Mill, at Janesville, Wis., was burned, Apr. 14. Loss, $25,000, covered by insurance.

The Blodgett-McCready Cheese Co., Marshfield, Wis., will double the capacity of its cold-storage plant.

The building at 442 National Ave., Milwaukee, Wis., occupied in part by William Mueller, cigar manufacturer, was damaged to the extent of $1800 by fire, Apr. 20.

The American Malted Food Co., Milwaukee, Wis., will erect a plant near Bethesda Park. H. C. Hengel is the architect.

The Jersild Knitting Co., Neenah, Wis., will erect a three-story factory.

The Standard Feather Mattress Co., at Neenah, Wis., was recently organized here and will establish a large plant for the manufacture of mattresses.

The Prairie City Canning Co., Prairie du Chien, Wis., which was recently incorporated, will erect a three-story brick factory. Frid Hur is the architect.

The Advancement Association, Watertown, Wis., is considering plans for the construction of a plant to manufacture fiber milk bottles. The daily capacity is 100,000 bottles.

The Board of Control, Madison, Wis., will establish a twine plant, at Waupun, Wis.

WEST OF THE MISSISSIPPI

The Iowa City Canning Co., Iowa City, Iowa, recently incorporated, will build a factory, to cost about $60,000.

A. F. Wentworth will erect a canning factory, to cost about $150,000, at Norfolk, Neb.

The city of Bruce, S. D., contemplates the installation of a municipal water-works system.

The Eureka Bakery at Pierre, S. D., was damaged by fire, Apr. 17. Loss, $2500.

The plant of the Henry Quellmalz Lumber Mfg. Co., manufacturer of wooden agricultural implements, The Levee, between Barton and Victor Sts., St. Louis, Mo., was damaged by fire, Apr. 24. Loss, $55,000, covered by insurance.

The Koken Barber Supply Co., St. Louis, Mo., maker of barbers' chairs, is building a factory. The estimated cost is $200,000.

The Lacquer-All Mfg. Co., Dallas, Tex., which has been recently incorporated, will erect a factory for the manufacture of paints and lacquers. The estimated cost is $25,000.

The town of Frankston, Tex., contemplates the construction of an electric-light and water-works plant.

The J. C. Carpenter Fig Co., Houston, Tex., has secured a site and will erect a preserving plant just south of Genoa, Tex.

The Alpine Wax Factory, Houston, Tex., has started the construction of a new fireproof factory.

The citizens of Terrell, Tex., have voted bonds for $25,000 for water-works improvements.

The city of Sherman, Tex., will extend its sewer and water-works systems at a cost of about $40,000. P. C. Thurmond is city engineer.

The plants of the Vinita Refining Co., at Vinita, Okla., and of the Chelsea Refining Co., at Chelsea, were destroyed by fire, Apr. 25. The total loss is estimated at $250,000.

Fire in the Vienna Bakery, 911 Fifteenth St., Denver, Colo., caused a loss of $25,000, Apr. 17.

John B. Gill, Roswell, N. M., will erect a fruit-canning plant, at Dexter, N. M.

WESTERN STATES

The city of Culdesac, Idaho, is contemplating the erection of an electric-lighting plant.

C. W. Kinney and C. A. Kolb, Fallon, Nev., are planning for the erection of a salt-grinding plant, at Fallon.

The city of Bremerton, Wash., will make improvements to its water system, to cost $150,000. Bonds have been voted.

The Index Galena Co. will build a shingle mill, at Index, Wash.

The plant of the Mumby Shingle Co., Olympia, Wash., was damaged by fire to the extent of $10,000.

The Yakima Sheep Co., Seattle, Wash., will erect a large refrigerating plant in connection with the Westlake Market, on Sixth St. L. R. Witt is manager.

Swift & Co., Chicago, Ill., meat packers, will build one of the largest and most modern butter-making and creamery plants on the coast, in Seattle, Wash. It will have an initial capacity of 10,000 lb. of butter daily.

The Siuslaw Creamery Co., Acme, Ore., recently incorporated by E. L. McCormick, C. C. Cushman and William Boring, will erect a creamery plant at Acme.

The Junction City Coöperative Creamery Co., Junction City, Ore., will erect a new creamery plant. An ice-making plant will be erected in connection with the creamery.

The Columbia Creosoting Co., Portland, Ore., has started the erection of a new plant, at Burlington, near Portland. It is estimated to cost $40,000. Landon R. Mason is manager.

The city of Woodburn, Ore., is planning to improve its water-works system.

The hydrate plant at the works of the Shasta Lime Products Co., Heroult, Calif., was damaged by fire, Apr. 6. Loss, $4000.

The Hammond Lumber Co., San Francisco, Calif., is considering plans for the construction of a sash and door factory, on South Alameda St., Los Angeles, Calif. The estimated cost is $100,000. A. B. Hammond, San Francisco, is president.

Fire in the plant of the Illinois Pacific Glass Co., 312 North Los Angeles St., Los Angeles, Calif., caused $5000 damage, Apr. 15. The loss is covered by insurance.

The Globe Grain & Milling Co., Los Angeles, Calif., will build a plant at the Los Angeles harbor. The estimated cost is $100,000.

The Feather River Power & Irrigation Co., Oroville, Calif., has been incorporated with a capital stock of $10,000,000, by W. P. Hammon, A. N. Leis and H. J. Hill. The company will erect a large power plant in the Feather River cañon.

The Richvale Colony Co., Oroville, Calif., will erect a large rice mill, in the Richvale Colony, near Oroville.

A. Licalzi, Riverside, Calif., is planning to erect a brick curing and packing plant for lemons, at Riverside.

The contract has been awarded for the second unit of the power plant of the Southern Sierras Light & Power Co., San Bernardino, Calif. The building will be 70 ft. square, of reinforced-concrete construction. Capacity, 15,000 hp. Estimated cost, $20,000.

The Standard Oil Co. will erect a modern plant at River and Portrero Sts., Santa Cruz, Calif.

J. B. Cram, San Francisco, Calif., will erect a woodworking plant, at Mesa, Ariz.

Samuel Henery, Stockton, Calif., will install an isolated electric-light and power plant to serve his property. The estimated cost is $20,000.

The Lake County Canning Co., Ukiah, Calif., will erect a large bean-canning plant. C. L. Crawford is president.

The Watsonville Water Co., Watsonville, Calif., will erect a large pumping plant.

The Canoe Pass Packing Co., Seattle, Wash., will build a new salmon-canning plant, on Canoe Pass, about 60 miles northwest of Ketchikan, Alaska. W. L. Robb, Portland, Ore., represents the company.

The Midnight Sun Packing Co., Seattle, Wash., recently organized, will build a salmon-canning plant, on Kotzebue Sound, Alaska.

CANADA

The Blythe Flax Mill, Blythe, Ont., will build a new mill.

Plans are being prepared and bids will soon be asked for the erection of a plant, at Guelph, Ont., for the Dominion Linen Mill, which at present is operating a mill at Bracebridge, Ont.

The plant of the American Can Co., Hamilton, Ont., was damaged by fire, Apr. 23. Loss, about $15,000, covered by insurance.

D. S. Perrin & Co., London, Ont., is planning to erect a biscuit factory to cost about $250,000.

The Swift Canadian Co., Toronto, Ont., a subsidiary of Swift & Co., Chicago, Ill., will enlarge its plant. An eight-story addition is under construction.

J. F. Wellwood & Co. will erect a paper mill and cardboard factory on Poplar and Lewis Sts., Elmwood, Winnipeg, Man. The estimated cost is $125,000.

The Regina Cold Storage Co., Regina, Sask., is constructing a plant at Regina.

G. M. Loyd, Waitsburg, Wash., is planning the erection of a cold-storage plant.

NEW INCORPORATIONS

GENERAL MANUFACTURING

The following companies have been incorporated to manufacture:

The Seamans & Cobb Thread Mills, Portland, Maine; thread and fabrics. Capital, $50,000. Incorporators: C. E. Eaton, J. E. Mantor and T. S. Croteau.

The International Plate Glass Co., Boston, Mass.; glass. Capital, $50,000. Incorporators: Antonio Toppiano, Orient Heights; Leon J. Lodi, Dorchester, and Samuel W. Culver, 85 Water St., Boston.

The Woodside Mills, Northboro, Mass.; woolen goods. Capital, $100,000. Incorporators: Randall B. Greene, Medford; George H. Felt, Northboro, and Osgar H. Bragdon, Melrose.

The Enterprise Bag & Suit Case Co., Inc., Brooklyn, N. Y.; suit cases, bags and leather goods. Capital, $20,000. Incorporators: Abraham Behrman, Benjamin Behrman, 138 Duane St., New York, and Leopold Schwartz, 167 Underhill Ave., Brooklyn.

The Hartford-Fairmont Co., Canajoharie, N. Y.; glassware. Capital, $60,000. Incorporators: Ernest W. Smith, 847 Main St., Hartford, Conn.; Bartlett Arkell, 95 Broad St., New York, N. Y., and Lyell T. Hallett, Canajoharie, N. Y.

The Monarch Stationery & Paper Co., Jamestown, N. Y.; stationery. Capital, $15,000. Incorporators: C. Emil Moller, Charles A. Blomquist and J. D. Curtiss.

The Arachne Mills Co., Manhattan, N. Y.; silk, wool and cotton fabrics. Capital, $250,000. Incorporators: F. A. Tierney, H. Stern, New York, N. Y.; J. E. Manix, Brooklyn.

The Rubber-Aer Co., Manhattan, N. Y.; rubber goods and substitutes. Capital, $25,000. Incorporators: D. B. Crane, Jr., Woodhaven; E. Lavoir, New York, N. Y., and H. M. Smith, Westfield, N. J.

The Eclipse Rubber & Tire Co., Manhattan, N. Y.; tires and rubber goods. Capital, $50,000. Incorporators: Simon I. Swartz, 347 Fifth Ave., Samuel H. Silverman and Harry A. Bloomberg, 5 Beekman St.

The Grand Rapids Home Furnishing Co., Manhattan, N. Y.; furniture and household goods. Capital, $250,000. Incorporators: Tobias Blumenthal, Louis Blumenthal, both of 50 Morningside Park, and Wolf H. Lobel, 138 Second Ave., New York, N. Y.

The Improved Power Table Co., Manhattan, N. Y.; sewing machines and power tables. Capital, $10,000. Incorporators: George Minkowitz, 275 Grand St., Brooklyn; Abraham Shulder and William Shulder, both of 143 Broome St., New York, N. Y.

The Skriwanek Button Co., Manhattan, N. Y.; buttons. Capital, $25,000. Incorporators: C. Isaar, R. W. Cronrath and P. Skriwanek, New York, N. Y.

The Victor Bottle Co., Manhattan, N. Y.; bottles. Capital, $25,000. Incorporators: A. Greenhut, N. Sender and J. Sender, New York, N. Y.

The Sponge Rubber Inner Heel Co., Manhattan, N. Y.; detachable ventilators for boots. Capital, $25,000. Incorporators: A. M. Patch, Lebanon, Penn.; L. E. Ginn and W. B. Price, New York, N. Y.

The Fireproof Wall & Panel Board Co., Manhattan, N. Y.; fireproofing materials. Capital, $25,000. Incorporators: W. L. Sawyer, W. A. Loeb and L. W. Mercer, New York, N. Y.

The Barnes Desk Co., New City, N. Y.; desks and cabinets. Capital, $10,000. Incorporators: Barker D. Leich, 314 Monroe St., Brooklyn; Ralph O. L. Fay, Nanuet, N. Y., and Norman W. Cole, Sherman Square Hotel, New York, N. Y.

The Camden Eggette Co., Camden, N. J.; fuel manufactured either from natural substance or artificial products. Capital, $150,000. Incorporators: F. R. Hansell, G. H. B. Martin and J. C. Clow.

The Fidelity Pearl Button Co., East Orange, N. J.; buttons of all kinds. Capital, $25,000. Incorporators: F. E. Ruggles, C. O. Geyer and L. Mathews.

The Keesey Hosiery Co., Mt. Holly, N. J.; hosiery and knit goods. Capital, $125,000. Incorporators: J. Keesey, C. Coles and W. Allen.

The Brandt Mills, Paterson, N. J.; silk and other textile fabrics. Capital, $50,000. Incorporators: P. L. Brandt, S. Simons, New York, N. Y., and C. Mazuy, Paterson.

The Universal Clothes-Drier Co., Rutherford, N. J.; clothes-driers and attachments. Capital, $100,000. Incorporators: H. E. Bresnahan, Henry E. Bresnahan and S. C. Ridden.

The Samuel Kline Co., Trenton, N. J.; barbers' furniture and supplies. Capital, $50,000. Incorporators: S. Kline, W. O. Anderson and F. R. Brace.

The Tennessee Chair Co., Greenville, Tenn.; chairs. Capital, $50,000. Incorporators: J. S. Moore, E. P. Moore and W. C. Todd.

The Stark Rubber & Novelty Co., Canton, Ohio; rubber soap trays and rubber bed springs. Capital, $100,000. Incorporators: J. J. Lisbae, W. A. Stafford and D. L. Holwick.

The Guide Motor Lamp Manufacturing Co., Cleveland, Ohio; general manufacturing. Capital, $100,000. Incorporators: H. J. Monson, W. F. Persons and W. H. Bunce.

The Auburn Handle Co., Auburn, Ind.; wood handles. Capital, $12,000. Incorporators: Caroline Buck, R. W. Vaughn and C. D. Buck.

B. W. Bennett & Co., Muncie, Ind.; brick and clay products. Capital, $10,000. Incorporators: B. W. Bennett, P. K. Morrison and A. D. Paden.

The Farrington Case Co., Chicago, Ill.; jewelry boxes and cases. Capital, $2500. Incorporators: James F. Sanborn, Harry S. Farrington and George E. Hills.

The M. Reichardt & Son Piano Mfg. Co., Chicago, Ill. Capital, $100,000. Incorporators: Max Reichardt, Richard Eberhardt and Louise M. Eberhardt.

Business Items

The Hoskins Mfg. Co., Detroit, Mich., has opened an office in Pittsburg, Oliver Building.

Charles A. Schieren Co., New York City, has been awarded a grand prize for its exhibit of leather belting at the Brussels exposition.

On May 1 the Chicago offices of Niles-Bement-Pond Co. will be moved from the Commercial National Bank Building to the McCormick Building, 332 South Michigan Ave.

The selling arrangements which have existed between the Billings & Spencer Co., of Hartford, Conn., and the Claire L. Barnes Co., of Chicago, Ill., have been discontinued by mutual consent. In the future the Billings & Spencer Co. will market its product of forgings and tools direct.

Trade Catalogs

Watson-Stillman Co., New York City. Bulletin J. Filling liquid for hydraulic tools.

The Adams Co., Dubuque, Iowa. Circular No. 812. No. 4 Farwell Universal Gear Hobber.

Lakeside Forge Co., Erie, Penn. Catalog W. Drop forgings. Illustrated, 52 pages, 5x7½ in.

New Process Twist Drill Co., Taunton, Mass. Catalog. Twist drills. Illustrated, 54 pages, 6x9 in.

Ball & Roller Bearing Co., Danbury, Conn. Catalog. Ball and roller bearings. Illustrated, 32 pages, 6x9 in.

Lumen Bearing Co., Buffalo, N. Y. Catalog. Bronze, brass and aluminum castings. Babbitt metal solder. Illustrated, 40 pages, 9¼x7¼ in.

American Electric Tool Co., West Newton, Mass. Bulletin No. 1. Electric drill. Illustrated, 4 pages, 6x9 in. Bulletin No. 2. Combined bench and tool post grinder. Illustrated, 4 pages, 6x9 in. Bulletin No. 3. Portable drill. Illustrated, 2 pages, 6x9 in. Bulletin No. 4. Type 3-A Electric drill. Illustrated, 4 pages, 6x9 in.

Forthcoming Meetings

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association, Southern Supply and Machinery Dealers' Association. Triple convention, May 13-15, Norfolk, Va., Hotel Monticello. F. A. Mitchell, secretary, 309 Broadway, New York City.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

National Machine Tool Builders' Association. Semi-annual convention, May 16-17, Atlantic City, Hotel Chalfonte. men. Regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

Society of Automobile Engineers, summer meeting, June 27-29, Hotel Ponchartrain, Detroit, Mich. C. F. Clarkson, secretary, 1451 Broadway, New York City.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month. Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

FOREMAN—Thoroughly competent for head of planer department, who is conversant with modern planing methods; references required. The Whitlock Printing Press Mfg. Co., Derby, Conn.

FOREMAN, familiar with uptodate manufacturing methods on high grade engine or machine work, and capable of producing results with thirty to fifty men. In reply state experience and salary expected and give references. Box 578, Waterbury, Conn.

FOREMAN, to take charge of bolt-threading department; must thoroughly understand thread cutting in all particulars, also the operation of the various types of threading machines, and be competent to manage help; only first-class man need apply. Box 165, Am. Machinist.

DESIGNER—By large Eastern manufacturer of machine tools, machinery and mechanical specialties, a chief designer of proven ability; a record of achievement is essential, and all applicants to receive consideration must be thoroughly explicit in describing their records; past and present employers, age and salary expected should be stated; all applications will be treated with strict confidence and no inquiries regarding any will be made without first consulting applicant. Box 245, Am. Machinist.

Illinois

DRAFTSMAN or designer; high grade man who has had experience on tools and jigs and can work up designs of various commercial items in metal and wood; prefer man who has had some shop experience; give experience and wage expected. Box 259, Am. Mach.

WE ARE constantly in need of the services of first-class draftsmen and tracers; some men are required on tool work and it is possible to place some on detailed and assembled drawings of agricultural implements. Applications requested addressed David Bradley Manufacturing Works, Bradley, Ill.

Indiana

HARDENER, one with large experience in hardening all kinds of steel gears. Box 236, Am. Machinist.

Iowa

MECHANIC, first class, capable of handling gear cutting in a large factory in Iowa; must be familiar with all kinds of gears, bevel, spiral and spur. Box 253, Am. Machinist.

Maryland

DRAFTSMAN, experienced in high-speed stationary engines. Box 227, Am. Machinist.

DRAFTSMEN on steel hulls for barges; detail work; permanent positions to competent men. Box 250, Am. Machinist.

DRAFTSMEN, experienced on dredging machinery and marine work; also competent structural and hull draftsmen. Box 59, Am. Machinist.

DRAFTSMEN, eperienced on general heavy machine work, steam engines and steel hulls; state age and experience. Address George Smith, 709 Second St., Canton, Baltimore, Md.

Massachusetts

DESIGNERS AND DRAFTSMEN, accustomed to rotary and flat-bed printing presses; excellent position for those who can qualify; apply giving former positions and references, salary expected, also age and if married. Box 237, Am. Machinist.

Michigan

OPERATORS—We are frequently needing good operators for turrets and gear cutters, principally Jones & Lamson and Gleason, and invite applications. Frost Gear & Machine Co., Jackson, Mich.

New Jersey

SUPERINTENDENT, capable of taking full charge of large modern shop employing several hundred hands manufacturing fine brass goods and light high-grade electrical machinery; must be practical mechanic in all trades involved and able to train foremen; want man with long, successful record, now employed and making good, who will change only for larger salary and opportunity. Box 224, Am. Machinist.

New York

MACHINISTS for bench and tool work; give experience and just what kind of work you are best acquainted with, also salary expected. Box 261, Am. Mach.

OPERATOR, first class, on two inch Jones & Lamson machine; state experience, salary expected and how soon could begin work. Box 262, Am. Mach.

FOREMAN—Sharp, hustling, uptodate experienced in lubricator and oil-pump work; piece system; give age, experience, reference and salary expected. Box 226, Am. Machinist.

FOREMAN to take charge of small manufacturing plant of automobile parts; must be a hustler and bring results. Apply by letter, stating experience, salary and give references, to Box 273, Am. Machinist.

MECHANICAL DRAFTSMAN, thoroughly competent, who has a complete knowledge of flour blending, sifting and weighing machinery; give experience, references, salary expected, etc., in first letter. Box 189, Am. Machinist.

PRESS ROOM FOREMAN for a Brooklyn shop; one who is capable of handling one hundred or more men on a varied class of work, drawing, blanking and forming in iron, brass and copper, both heavy and light. Reply must contain full particulars as to experience, age and salary expected, also how soon could begin work. Box 263, Am. Machinist.

Ohio

SHOP FOREMAN, thoroughly uptodate, experienced. Box 257, Am. Machinist.

JIG AND DIE MAKERS, first-class, on small, accurate, interchangeable parts. Box 264, Am. Machinist.

CAPABLE MAN with mechanical experience, familiar with factory costs and efficiency work, by a large manufacturing concern of mechanics' small tools, in the Middle West; good position for right man; give full information as to experience, references, age, married or single, salary expected, etc.; only those qualified for this particular work need apply. Box 212, Am. Machinist.

DESIGNER, with experience on machine tool work, preferably lathes and their attachments; applicant must have had several years' experience in the shop as well as the drafting room, and be capable of instructing his assistants;

please do not apply for this position unless you are sure you can fill the above requirements; liberal salary and fair treatment assured. Box 256, Am. Mach.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

OPERATORS — First-class automatic screw-machine operators, familiar with Cleveland machines; steady work. Apply to Flannery Bolt Co., Bridgeville, Penn.

MECHANICAL DRAFTSMEN, experienced in the design of motors, generators and detail apparatus, such as controllers, switchboards, circuit breakers, etc.; state experience and salary expected; only first class men need apply. Address "Chief Clerk," Engineering Department, Westinghouse Electric & Mfg. Co., East Pittsburg, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wisconsin

FOREMAN, to assist general foreman of tools in automobile-part manufactory; must have thorough knowledge of modern jigs, fixtures, punches and dies, and have successfully held a like position on automobile parts, or equal; state full particulars and salary expected. Box 222, Am. Machinist.

FOREMAN, to take complete charge of grinding section in automobile-part manufactory; must have successfully handled such a position on automobile parts, or equal; this section includes universal, surface and rough grinding, also polishing; state full particulars and salary expected. Box 221, Am. Machinist.

ANALYTICAL CHEMIST and metallurgist, by large manufacturer; we are looking for a man who has thorough knowledge of steels and who has sufficient experience to enable him to supervise work of hardening, tempering, etc.; here is a good opportunity for a first-class man; give all particulars. Address "Automobile," Am. Machinist.

BECAUSE of the rapid growth in our business we are constantly on the lookout for keen, able and practical men in the various departments of our works; for men above the average such positions offer splendid opportunities; in addition to our assembling rooms, we operate our own machine shops, drop forge plant, foundries and body works and invite correspondence from men whose experience convinces them that their ability is above the ordinary; one-third of our present employees have been with the management of this company from eight to twenty-six years. Address Factory Manager, The Thomas B. Jeffery Co., Kenosha, Wisconsin.

Positions Wanted

Connecticut

ASSISTANT PRODUCTION or routing man by first class general machinist; 11 years' experience; fair knowledge of drafting; sober and ambitious young man; 27 years; can obtain A-1 references from present employers. Box 271, Am. Machinist.

Indiana

IGNITION EXPERT, at present employed by leading firm in this country, would like to make a change; for the last two years assistant superintendent; first-class mechanic and able to get results where precision work is required. Box 230, Am. Machinist.

Massachusetts

DRAFTSMAN, young man, technical training, six months' experience in drafting room; first class references. Box 251, Am. Machinist.

PURCHASING AGENT, mechanical education, four years with large automobile manufacturer, desires permanent position with manufacturing company; location immaterial. Box 266, Am. Mach.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 275, Am. Machinist.

DESIGNER, experienced in designing special and automatic machinery, wants position. Box 483, Am. Machinist.

DRAFTSMAN that can show a good record for designing light machinery; inventive, accurate and reliable. Box 277, Am. Machinist.

SUPERINTENDENT and manager of large concern desires change; have made good in present position for nine years. Box 168, Am. Machinist.

TOOL DESIGNER, experienced, with excellent references, technical graduate, wishes permanent position; will go anywhere. Box 258, Am. Machinist.

DRAFTSMAN with knowledge of jigs and fixtures, also machine shop experience, would like position as draftsman or assistant foreman. Box 254, Am. Ma.

DRAFTSMAN, practical designer of automatic machinery; technical education; first-class shop and office experience; good references. Box 276, Am. Machinist.

TECHNICAL MAN, thoroughly experienced in design, construction and mechanical equipment, ambitious and capable of assuming responsibility, is looking for opportunity with a future. Box 232, Am. Machinist.

MECHANICAL ENGINEER, also electrical, at present manager of plant manufacturing automobile gears and parts, desires change; position with a future rather than a high salary desired; undoubted reference as to character and ability. Box 270, Am. Machinist.

CHIEF DRAFTSMAN, now with large concern, wishes similar position, or as designer; thirteen years' practical experience covering wide range of important work; good executive ability and thoroughly reliable; any location, but prefer Middle West. Box 255, Am. Mach.

WORKS MANAGER or general superintendent by a first-class executive of 18 years' experience; experienced on automobiles, typewriters, firearms and electric goods; thorough systematizer, capable of installing standard time or bonus systems for increasing production and reducing costs; best of references. Address Box 274, Am. Machinist.

CONTEMPLATING to withdraw as a member of a firm where I have been engaged for a number of years on designing and manufacturing electrical mechanical instruments, special machinery, tools, jigs, dies, etc.; I am well conversant with modern methods; can conduct a plant to best advantage; able to handle English and German correspondence; could some reliable concern use my service and appreciate untiring efforts? Box 265, Am. Machinist.

IF YOU ARE LOOKING for a man with executive ability, which has experience in the manufacture of small interchangeable parts, communicate with me; I have special experience in fire alarm boxes, news tickers, speedometers, taximeters, and all electrical apparatus applied to the automobile, and am at present holding a responsible position in one of the largest concerns in this country manufacturing above mentioned articles. Address "Live Wire," Box 252, Am. Mach.

GENERAL MANAGER — Highly educated mechanical engineer, still general manager of a big concern in Europe, would like to get position here as general manager in a large manufacturing or power plant; speaks English, German, French, Hungarian; has 10 years' practical experience in gas, steam, oil engines, heating and ventilating installation. First-class organizer, who can bring your executive costs down to a minimum in relation to the output, which will make him paid easily; salary about $6000 and interest in dividends; agents forbidden. Box 211, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

PATTERN FOREMAN, A-1 on high class steam, water and electric work, also machinery; rare foundry practice, molding machines, etc.; large concern preferred. Box 272, Am. Machinist.

ASSISTANT SUPERINTENDENT, by technical graduate, 29 years of age; has had seven years' experience as designer in various lines of machine tools and special automatic machinery; competent tool designer; well posted on modern manufacturing methods and shop practice; executive ability; references; at present holds position as tool designer; will make a change if he can secure the right position; location and salary will be secondary considerations. Box 268, Am. Machinist.

Pennsylvania

FOREMAN of repair, jobbing or small manufacturing shop, by married man, age 28; have had five years' experience as foreman of repair shop at large tinplate mill; have had 4½ years' experience in jobbing and manufacturing shops and seven years in rolling mill shops; good at rigging up for jobs not suited to equipment; good references. Box 269, Am. Machinist.

GENERAL SUPERINTENDENT as manager of a large plant, by a competent man holding similar positions for the last 15 years; thoroughly familiar with the machine business from the foundry to the finished product; large steam and gas engines, turbines, pumps and condensers; can produce good work at moderate cost; have never had any labor trouble. Box 248, Am. Machinist.

Wisconsin

MACHINIST, technical graduate, 26, five years' shop experience, all-round machinist, excellent draftsman, experienced in shop methods and systems, capable, energetic, ambitious, wants responsible position in Middle West. Box 260, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

Production increased, quality improved. James F. Hobart, efficiency engineer, Box 133, Am. Machinist.

Second-hand foundry pressure blower wanted, size 3, Roots preferred. E. N. Camp & Sons Co., Moreland, Ga.

Work for 2x24 Jones & Lamson lathes and work for automatic gear cutters wanted. Box 267, Am. Machinist.

Radial drill wanted, in first-class condition; 3½-ft. or 4-ft. arm; state make, age, delivery and price. Box 239, Am. Machinist.

For Sale—One 8"x24" Allis-Chalmers Corliss engine; one four-spindle Turner cock grinder; first-class condition. For prices apply to J. E. Lonergan Co., 211 Race St., Philadelphia, Penn.

Machine shops and foundries desirous of manufacturing and marketing a profitable specialty, in the line of fixture, device or machine requiring but little capital, should communicate with the Engineering Service Co., Box 463, Williamsport, Penn.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

Proposals for Ordnance Supplies—Watervliet Arsenal, Watervliet, N. Y., April 25, 1912—Sealed proposals, in triplicate, will be received until 1 p.m., May 25, 1912, for furnishing steel, hardware, forage, fuel, oils, etc., during year ending June 30, 1913. Information furnished on application. Lt.-Col. W. W. Gibson.

Machine tools and small tools—Alfred Herbert, Ltd., Coventry, having an extensive organization and a large staff of salesmen specially engaged on machine tools and small tools in Great Britain, France, Germany, Italy, Switzerland, Belgium, India and Japan, are open to handle good agencies of all kinds and invite correspondence with manufacturers.

Talks With Our Readers

By The Sales Manager

Every now and then some non-believer questions the value of advertising.

He admits that a few glance over the advertising pages, but says the busy man hasn't time to read them.

He forgets that the busy and responsible man is the very one who cannot afford not to keep up with every time and labor saving element in his field—

That they are the very ones who need it most.

The alert, intelligent, progressive, thinking men in the machine-making field buy the AMERICAN MACHINIST for the information it contains—for information about their work.

They know from experience that there is as much, if not more information in the advertising than in the reading columns.

The shortness of the advertisements as compared with the articles, the easiness with which an idea can be grasped in a good ad, oftentimes give them an advantage.

Here's a case where it is proven in a left-handed way:

The Union Twist Drill Company recently had an ad showing a large cut of a twist drill. Underneath it, the heading, "Here is the only place you can tell the quality of a tool before you try it." From the heading an arrow ran pointing to the name on the shank of the drill.

Through some error in our composing room a cut of a manufacturer other than the Union Twist Drill Company, appeared in the ad in place of the U.T. D. Co. cut. This error passed by six different people whose job it was to catch such a mistake.

It was not noticed until the ad appeared in the AMERICAN MACHINIST and a buyer of twist drills called our attention to it.

The Union Twist Drill Company, and we, have received letters from all over the country, and abroad, in regard to it.

Some of the people who say they never read advertising were the first to write.

John MacGregor, President of the Union Twist Drill Company, says it was one of the best ads he ever had.

It is, of course, annoying and embarrassing to have such an error creep in. It is less so, however, when we have to deal with such a considerate concern as the Union Twist Drill Company, who realize that the best and the worst of us are alike fallible.

But, when readers go to the trouble to point out an error in an advertisement, it shows how carefully the paper is read.

* * *

Only reliable products can be continuously advertised.

Safety Standards for Machine Tools

By David S. Beyer *

Why progress in safety work has been slow. Common causes of accidents.

Standards that would be mutually beneficial to builders and users of machine tools such as gear guards, covered planer beds, counterweight guards, safety thrust collars, etc.

*Chief safety inspector, American Steel & Wire Co., Pittsburg, Penn.

An article appeared in the AMERICAN MACHINIST, Vol. 33, Part II, page 1093, calling attention to various designs of gear covers that had been adopted by one of the prominent manufacturers of lathes. In conjunction with this article there was a number of illustrations showing conditions "before and after" the guards had been applied. The points considered were all good, and serve to illustrate the trend of public opinion in the direction of greater safety for workmen which is being felt in all other industrial lines, as well as that of machinery manufacture.

It is due the machine-tool builders to state that they, as a class, have been progressive in this matter and were among the first to recognize its importance. There is probably no other line of machinery that is as generally well protected as the machine tools which may be bought in the open market today. There is still a tendency, however, on the part of some manufacturers to lag behind the average and to submit to the more stringent safety requirements that are now being called for, only when compelled to do so, and then with rather poor grace.

One of the reasons why this is so, and undoubtedly the chief one, is the absence of any well-defined standard, to be met by tool builders, on a competitive basis. The legislation bearing on this subject in the different states varies considerably, and the interpretation of this legislation varies even more. Much confusion would, therefore, result if a manufacturer having a wide range of territory, endeavored to study out every local requirement, and arrange his equipment in accordance therewith. Even in an individual state the laws are usually of such a general nature, and so vaguely defined, that there is opportunity for an endless argument if one is inclined to quibble and hold out for fine distinctions. Take for example the following, quoted from the statutes of the State of Pennsylvania.

> Whenever practicable all machinery shall be provided with loose pulleys. All vats, pans, saws, planers, cogs, gearing, belting, shafting, setscrews, grindstones, emery wheels, flywheels, and machinery of every description shall be properly guarded.

It will be noted that this begins and ends with qualifying words, and there is no further definition as to how much is included (or "omitted") by the term "whenever practicable." Equally indefinite is the meaning of the phrase "properly guarded." The interpretation which shall be placed on these flexible terms in each individual case is left to the State Factory Inspection Department, and obviously it is impossible for the factory inspectors to keep in sufficiently close touch with all of the machinery in a great industrial state like Pennsylvania, to know whether their interpretation is being applied or not.

Looking at it from the other side, an owner or an operator may be running his machinery, believing in all good faith that it is properly guarded, but when an accident occurs and he is sued for damages, the prosecuting attorney naturally takes advantage of the condition described and insists that the fact that an accident did occur is the best possible proof that the machinery was *not* "properly guarded." This results in penalizing a man for a condition that is not legally defined with sufficient clearness to enable him to determine beforehand, whether he is within the scope of the law or not.

While it may be desirable to allow a certain amount of discretionary power in the application of safeguards to old machinery which was designed without any consideration for the need of such safeguards, there surely is no such need in the case of entirely new equipment. I think that anyone will agree that it is possible to design a new tool so that its gearing can be thoroughly and adequately guarded beyond doubt or question.

So long as this vagueness about what is required exists, machinery manufacturers will hesitate to make the necessary changes in their designs, to bring about ideal conditions. In fact there is a real inducement for not doing so, since the average purchaser looks chiefly at the price tag, and if he is convinced that a certain machine will do his work and will cost him less money, he is likely to overlook the fact that the absence of safeguards may be a factor in its low cost.

Thus the manufacturer who is conscientious and endeavors to live up to a high standard of safety, will likely lose desirable orders on account of his very conscientiousness, unless uniformity of standards can be brought about that will put everyone on an equal footing as regards the safeguards which must be furnished.

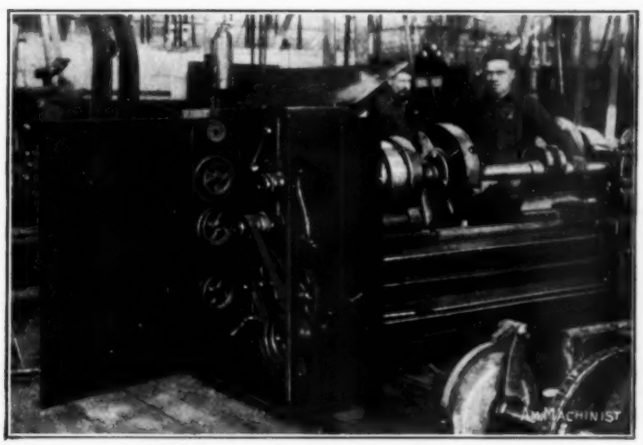


FIG. 1. GUARD FOR END GEARING OF LATHES

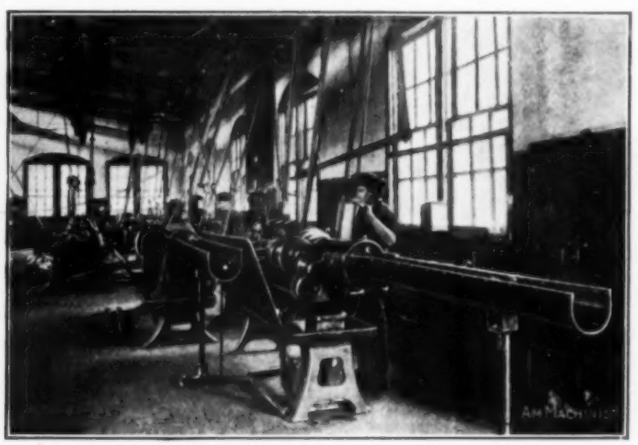


FIG. 3. GUARD FOR STOCK OF TURRET LATHE

SAFETY REQUIREMENTS FOR EQUIPMENT

Realizing the need of such standardization to govern the construction of manu-

facturing equipment purchased from outside builders, the subsidiary companies of the United States Steel Corporation have prepared specifications defining their safety requirements for various classes of equipment; those for machine and carpenter-shop tools read as follows:

GENERAL—(This clause applies to all machines.)

All gearing shall be completely inclosed with substantial cast-iron or sheet-steel covers, so designed as to be readily detachable; all couplings, setscrews, keys, bolts, etc., in moving parts, must be countersunk or covered in such a way as to eliminate danger of accident; unusued portion of keyways to be filled so as to present a smooth surface.

In addition to the above general specifications, the following provisions must be made for the various machines designated:

PLANERS—Planer beds shall be substantially covered with cast iron or steel plate—the latter, if used, to be not less than $\frac{3}{8}$ in. in thickness.

DRILLS—Wherever possible, counterweights should be placed inside the vertical column of drill presses. Where this cannot be done, some auxiliary means must be provided for retaining the weight in case the supporting chain or rope breaks, this weight being suspended in such a location as to offer the least possibility of injury in case it should fall.

GRINDING MACHINERY—Emery wheels must be provided with adequate safety hoods, having exhaust connections, these hoods to be of steel, not less than $\frac{3}{8}$ in. in thickness. Flanges must be at least half the diameter of the new wheel, and have cushion washer between the wheel and flange. Roll grinders, tool grinders, etc., are to have the wheel covered as completely as the character of the work will allow.

WOODWORKING MACHINERY—Jointers or surfacers must be equipped with standard safety cylinders, and have exhaust connections for removing shavings. Daniels' planers should be provided with a guard which will prevent the knives from flying out. Band saws are to have both the upper and lower wheels protected with woven wire or other suitable inclosure across the face of the wheel, and a guard at the rim to prevent a breaking saw from springing outward. Swing saws are to be covered as completely as the character of the work will allow.

INSPECTION—(This applies to all machines.)

These safety features shall be subject to the approval of the American Steel & Wire Co.'s inspectors, who shall be given an opportunity to inspect machinery at any time requested.

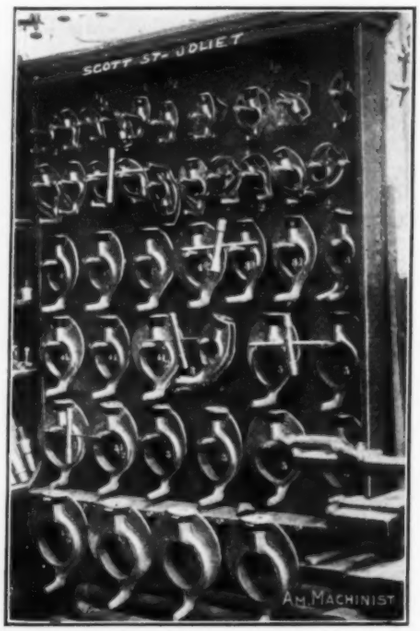


FIG. 2. SAFETY LATHE DOGS

It will be noted that the first requirement is that all gearing shall be *completely inclosed*. Exposed gearing is the chief shortcoming that may be found in all classes of machine tools. With the progress that has already been made in that direction, however, it is really not a very serious matter to carry this on to its logical conclusion, which has only been reached when all the gears are entirely encased. A sweeping requirement of this sort does away with the necessity for an argument in each individual case and allows every manufacturer to know exactly what he is bidding on, and he also knows that his competitor must bid on the same thing.

Next comes the matter of protecting couplings, setscrews, etc., which have been responsible for so many accidents through catching in a man's clothing and drawing him around a revolving shaft.

The other requirements for individual classes of tools are all such as actual experience has proved practicable and desirable. They are generally those that most machinery builders are now prepared to furnish if insisted upon, but which they are pretty certain to keep in the background where the purchaser says nothing about them.

MEETING THE SPECIFICATIONS

While a set of specifications performs a very definite and valuable function in securing the desired results, it is by no means a royal road to this end. Here again the conscientious individual will, of his own initiative, take hold of the matter in an intelligent way and fulfill its spirit.

A large order placed about a year ago by the American Steel & Wire Co. il-

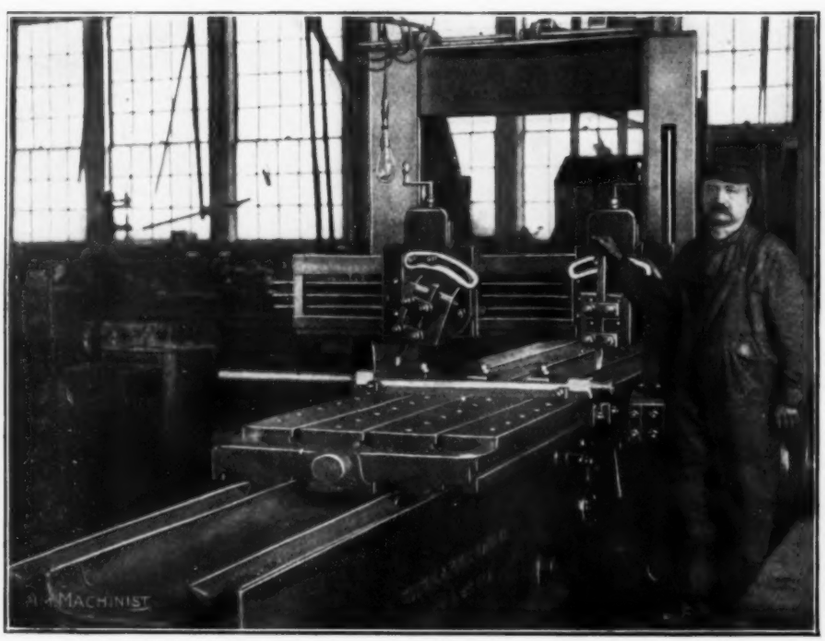


FIG. 4. PLANER WITH COVERED BED

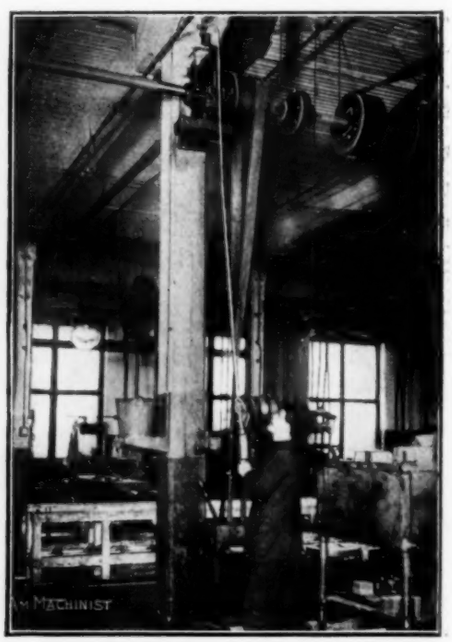


FIG. 5. OILING OVERHEAD SHAFTING FROM THE FLOOR

lustrates this point admirably. It covered the purchase of about eighty new tools, principally for machine-shop use, and involved the expenditure of as many thousands of dollars. In sending out the inquiries, each prospective bidder was furnished with a copy of the specifications given above and when the orders were placed it was with the distinct understanding that all safety requirements should be taken care of in accordance with the specifications.

To begin with, the standard design already in use was satisfactory in many cases, without necessitating any additions or changes, so that quite a large section of the order was thus eliminated from any danger of controversy. In two or three cases, manufacturers or agents wrote before shipment, asking in effect, if we were in earnest about it and if an exception could not be made in the case of *their* gearing, which was not very dangerous after all. On being assured that the specifications were to be taken seriously they arranged to comply with them without further question.

Out of the total number of eighty odd items, when checked up about thirty were found defective, principally as regards gear covers (twenty-five were in this class).

This led to a somewhat voluminous correspondence with ten or twelve different manufacturers and agents, with various sorts of explanations and apologies; most of these people arranged promptly to fix matters up satisfactorily, but in two or three cases there was an effort to evade compliance. One factory superintendent naïvely admitted that his company had guards designed for the tool in question, but that it had not sent them with the machine on account of the cost. He evidently thought their absence would be overlooked. Another said, in commenting on a pair of gears entirely open at the side, and one of which was only guarded half way around its circumference:

"We have built these machines in this form for many years and it would be impossible for an operator to get caught in this unless he deliberately took hold of the lower gear."

He did not seem to realize that in this statement he was convicting himself of being out of date and behind the time as regards protection and further admitted his noncompliance with a definite specification. These facts were brought to his attention, together with an illustration from one of the trade journals showing practically the same tool handled by one of his competitors, in which this pair of gears was entirely inclosed.

FIG. 6. ARRANGEMENT FOR SAFEGUARDING A COUNTERWEIGHT

In another case, the builder who had furnished several badly exposed drill presses, wrote regarding them: "An operator would have to deliberately put his hand into the cogs to be injured." He suggested a band of steel around the face of the gears to fix matters up.

Obiously this would not comply with the specifications, and would not meet the object aimed at. A great many people seem to have the idea that if a set of gears is out of reach above a man's head, or if a setscrew is located in such a place that his work would not bring him in direct contact with it, there is no danger, or that the danger can be ignored.

Anyone who makes a study of accidents and the conditions that lead up to them, will soon be convinced that this is not the case. In one respect, just the reverse is true, in that a danger which is obvious and imminent will make more of an impression on the workman, and he will take care to avoid it; where the source of danger is remote and more or less out of the way, a man is likely to forget about it and be caught entirely off his guard. The following cases, which have come under observation within the last year or two will illustrate the point.

ACCIDENTS AND WHAT CAUSED THEM

A man had his hand crushed off in a pair of gears about eight or nine feet from the floor and which ordinarily would have been entirely out of his reach; he stepped up on the frame of a machine to feel a bearing which he thought was getting hot, and in so doing inadvertently thrust his hand into the gears.

Another man received a similar injury on one of these safe (?) sets of gearing; he was trimming an arc lamp from a stepladder, and laid the loose globe on top of a machine which hap-

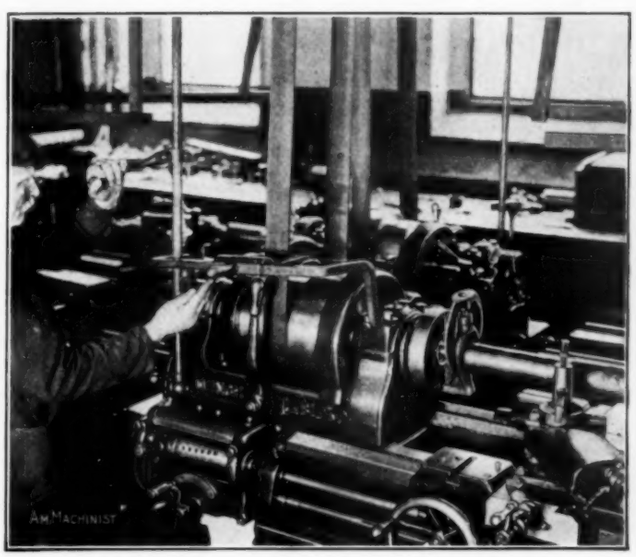


FIG. 7. BELT SHIFTER ON CONE PULLEYS

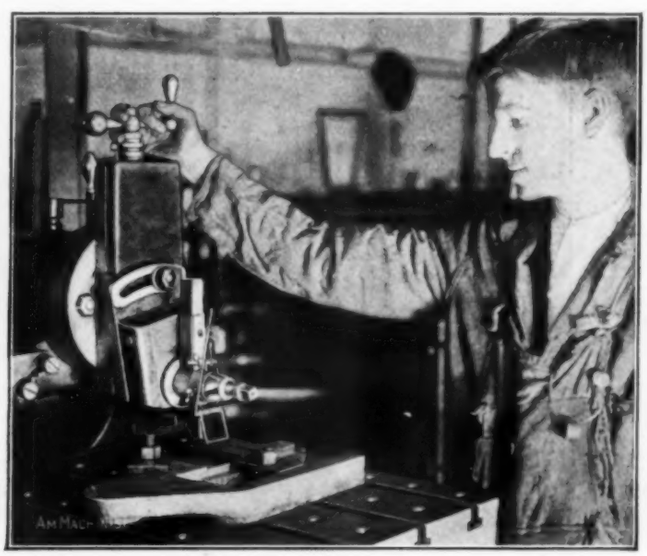


FIG. 8. CHIP GUARD TO PROTECT THE OPERATOR'S EYES

pened to be convenient at that elevation; the machine was started while he was there, and reaching hastily to catch the globe his hand was caught by the gears.

Another man was oiling his machine, and accidentally touched the shifter lever (which he might have locked in position, but had carelessly omitted to do) and the starting up of the machine surprised him into a mismove, that resulted in an accident similar to those already described.

In another case a pair of gears was located between two machines in such a position that the gears would ordinarily not be considered dangerous. They were covered over the top and ran "out" at the bottom, so that it would be impossible for anyone to be drawn through the mesh line and crushed. A girl operator at one of the machines dropped her glasses between them, and in reaching after the glasses brought her head in contact with the bottom of the gears, in which her hair became entangled, and her scalp was badly lacerated in consequence.

In another plant a recommendation had been made by one of the local committees for covering some gears in one of these "out-of-the-way" places. In going over the recommendation later, however, it was discarded as it did not seem to those following up the work that there was any appreciable element of danger as the gearing was already partly inclosed. Within a short time a workman accidentally dropped a tool inside the inclosure close to the gears, and in reaching after it had his hand caught and crushed.

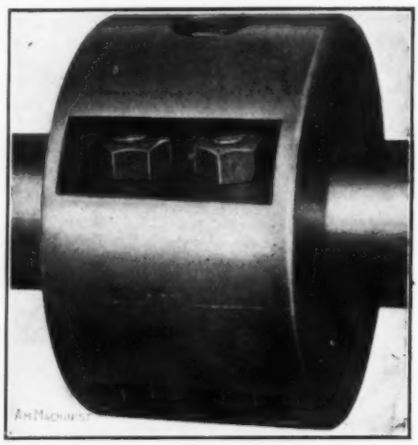


FIG. 9. SPLIT THRUST COLLAR WITH BOLT ENDS IN RECESS

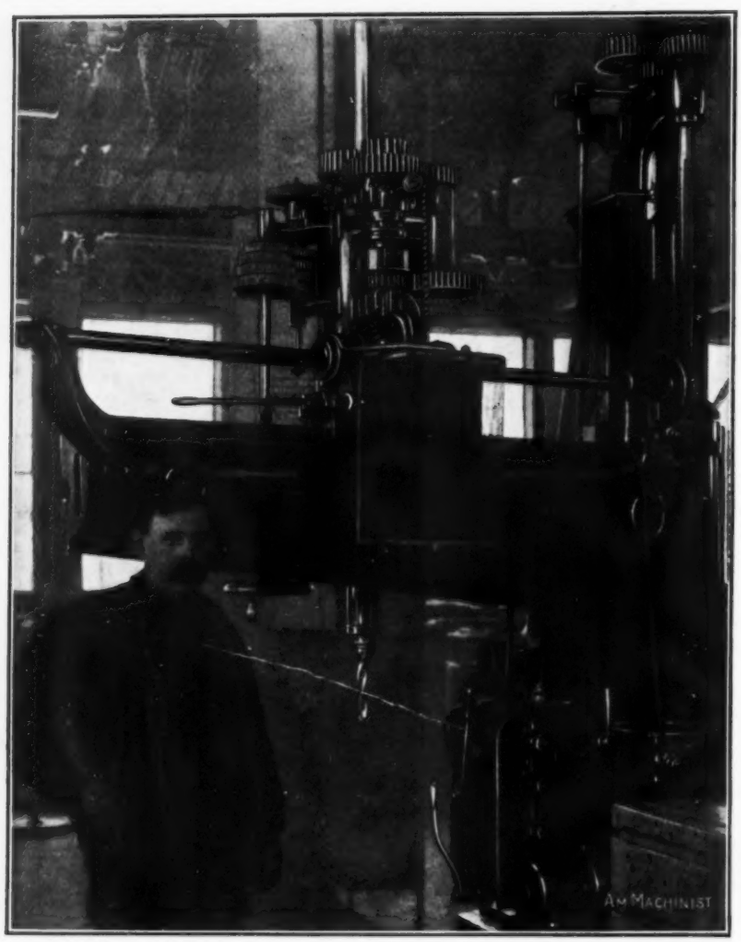


FIG. 10. GUARD FOR RADIAL-DRILL COUNTERWEIGHT

Another reason which is often given for omitting protection in cases of this kind is the slow speed at which the machinery runs, the idea being that where the movement is relatively slow, an operator would have time to escape in case he should be accidentally placed in a dangerous position. Within the past year three accidents occurred, two of them resulting in broken arms, and one in the loss of a hand, in machinery running from 5 to 8 revolutions a minute. To a casual observer this speed seems so slow that the danger would appear to be infinitesimally small.

It would be possible to continue this list indefinitely by reciting instances where some peculiar condition brings a man into an unusual location or position, and where a misstep or slip of some kind causes a sudden movement in an unexpected direction, thus bringing about an accident in places that would not ordinarily be considered hazardous.

Such experiences make it apparent that the only positive way to avoid accidents of this kind is to entirely inclose the gearing, irrespective of its location and arrangement. It is not sufficient merely to put a band across the face of the gear, as that usually leaves the side of the teeth exposed at the mesh line, and very often the gear has spokes through which a man's arm might be thrust and broken or crushed against an adjacent part of the frame. By this clause is meant that both the sides and the face of gears shall be so inclosed as to keep them entirely out of sight.

Incidentally it might be well to call attention to the fact that this gives improved operating conditions, aside from the safety feature, in that the gears are protected from dust and grit, and in some cases it is possible to have them running in oil, giving, in any event, increased life and efficiency.

In taking up the question of safeguards on the large order already mentioned, adjustments were secured on all the tools which fell short of the specification. In some cases the builders furnished new guards, and in others they authorized the company to construct these guards and charge them up with the expense. In general the former arrangement is more satisfactory, as the factory putting out the machinery is better prepared to construct the guards so that they will seem like an integral part of the machine, and add to its appearance rather than detract from it. This plan is also more satisfactory from the fact that the design must sometimes be changed before an adequate guard can be applied, and the logical place and time to take care of it is at the builder's factory, before the machine has been constructed.

In addition to the construction details of the machines proper there are various valuable types of auxiliary equipment such as safety lathe dogs in which the setscrew is protected; safety belt shifters for pulleys; guards for jointers, saws, emery wheels, driving belts, etc., some of

which are shown in practical operation in the illustrations.

Overhead shafting has contributed its good proportion of accidents, notwithstanding the fact that it is ordinarily out of reach. These accidents occur chiefly to men repairing belts or replacing them on pulleys, and to the oilers whose duty it is to look after the overhead bearings. The hazard to oilers can be largely reduced by the erection of suitable walks and platforms from which the shafting can be reached in safety. In some cases it is possible to use a long-spout oil can by which the bearings can be filled from the floor, in conjunction with suitable cups or pipes attached to the bearings.

Supplementing Safeguards with Caution

Aside from the question of mechanical safeguards, there is that of caution and care on the part of the workmen, which is a very important factor in the reduction of accidents. The attitude of the shop foreman is very largely reflected in the actions of his men, and just as he can insist on neatness and order being maintained in the shop, so he can educate the men under him to be cautious and careful of their own safety.

This is largely a personal matter and the foreman or superintendent can do more than anyone else to bring it about. A warning sign has some value, but it alone will not accomplish the desired result any more than the safety specifications already referred to will transform a dangerous machine into a safe one without the use of some personal persuasion.

Obviously the danger in connection with such work as cleaning, oiling, adjusting or repairing a machine is tenfold greater when it is running than when it is standing still, and where it is insisted upon, work under the former condition can be practically eliminated. In order to keep this matter fresh in the minds of its workmen, the following sign has been posted in the plants of the United States Steel Corporation:

OILING, WIPING,
REPAIRING, ETC.
MUST BE DONE
WHEREVER POSSIBLE
WHEN MACHINERY
IS SHUT DOWN.

and those in authority are instructed to see that the rule is enforced.

Improper clothing has contributed to many accidents. More than one lathe operator has had a four-in-hand tie wrapped around the revolving shaft in his machine with more or less disastrous results, and one case has been brought to notice where a flowing beard was suddenly abbreviated through a similar mishap. Such accidents prompted the preparation of another sign, reading as follows:

WARNING!
EMPLOYEES WORKING AROUND ENGINES, MOVING OR REVOLVING MACHINERY, SHAFTING, ETC., ARE WARNED AGAINST THE DANGER, AND ARE PROHIBITED FROM WEARING LOOSE OR UNBUTTONED JACKETS, BLOUSES, SHIRTS, TORN CLOTHING, LONG NECKTIES, ETC. ALWAYS WEAR OVERALL JACKET TUCKED INTO TROUSERS OR UNDER THE OVERALL BIB.

The various safety devices enumerated below refer specifically to the illustrations which show their application and operation. Of course, there are countless others, but those shown and described cover common sources of danger and are typical of the protection that can and should be afforded those who come in contact with such machinery.

Safety Appliances

Guard for End Gearing of Lathes—As a rule, the gearing on a modern lathe is quite thoroughly guarded when it leaves the builder's factory. Nearly every machine shop however, has some lathes of older design, with exposed gearing and belting. Fig. 1 illustrates an excellent arrangement for protecting a lathe of this sort. A box constructed of steel plate, has been placed around the end of the lathe with doors which may be quickly opened to give ready access to the gearing; this box serves as a locker or cupboard for carrying the spare gears belonging to the lathe, thus keeping them always conveniently at hand, and avoiding any danger of loss or breakage.

Rack of Safety Lathe Dogs—A number of safety lathe dogs on a frame or rack in the corner of a tool room is shown in Fig. 2. These dogs have a protective wing which inclose the setscrew so that there is no danger of anyone getting caught on it when it is revolving on the head of a lathe. The screws are operated by means of socket wrenches, several of which are hanging on the rack.

Fig. 11. Wood Planer with Safety Attachments

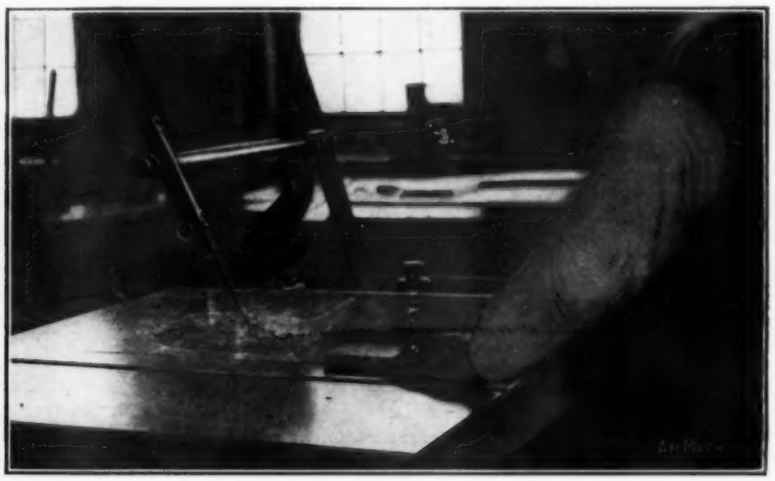


Fig. 12. A Convenient Form of Saw Guard

Guard for Stock of Turret Lathes—The shaft or bar which is fed into a turret lathe revolves as it is worked upon, sometimes at a relatively high rate of speed. More than one man has had his clothing twisted up on this stock, resulting in more or less serious injury. Fig. 3 shows a method for avoiding such accidents by having the stock revolve within a trough-shaped guard, which prevents anyone from coming in contact with it.

Planer with Covered Bed—Planer beds usually have "pockets" formed by ribs across the frame, and these pockets are often used by the workmen for storage purposes. Where this is done there is danger of a man's arm being caught by the moving carriage, when he reaches into one of the openings. There have also been accidents caused by men making a misstep from the carriage when it is in motion, and being crushed between it and one of the ribs. This danger may be avoided by placing a steel plate over the planer bed, as shown in Fig. 4, or by having the frame cast with a solid top.

Oiling Overhead Shafting from the Floor—One of the most dangerous oc-

cupations around a mill or factory is that of oiling shafting; this is commonly done from a ladder, and the oiler is likely to fall, on account of his ladder slipping, or to be caught on a revolving shaft or in moving machinery. Fig. 5 shows a man oiling a line of shafting from the floor by means of a long-spout can. A cup as been provided for the overhead bearing, in which it is an easy matter to place the curved point of the oil-can spout, and the oil is then forced into the cup by a syringe-like pumping action.

This not only eliminates danger to the oiler but it saves time as well, since a bearing can be filled more quickly this way than if it were necessary for the man to place a ladder and ascend and descend it at each bearing. Push buttons for stopping the engine driving the department will be noted on the columns in the background. Each button is numbered and has a blue enamel sign reading: "Engine Stop. In case of Emergency Push Button." A blue light is kept burning constantly beside it so as to facilitate finding the button quickly, and a blue band is painted entirely around the column, so it may be distinguished readily from the opposite side, where the button itself is invisible.

Safeguarding a Counterweight — In some cases a section of pipe or a cylinder of steel plate has been used to protect a counterweight, being placed so that the weight raises and lowers inside it. In the one shown in Fig. 6 a pit has been provided underneath the floor; this puts the counterweight entirely out of the way and saves some floor space. It is a desirable arrangement where the conditions are adapted to its use.

Shifter for Belts on Cone Pulleys—The belt is shifted on the upper cone, by revolving the vertical rod in the operator's left hand. There is also an arrangement for shifting it on the lower cone, so that there is no necessity for a workman touching the belt at all with his hands. In Fig. 7 a safety lathe dog is shown in position on the head of the lathe.

Chip Guard—This is a glass guard in a metal frame arranged for convenient attachment to the tool rest of shapers, lathes or other machines. As shown in Fig. 8 it protects the operator's eyes from particles which fly from bronze, tool steel, etc., when it is being cut or turned.

Safety Thrust Collar—Where the thrust on a collar is slight, a headless setscrew can usually be employed, but where the service is severe, it may be desirable to use a common type of square-head setscrew. If a solid collar can be applied, all that is necessary is to countersink the head of this screw so that it does not project beyond the surface, but where a split collar is necessary there is the added problem of how to protect the bolts holding the two halves together. Fig. 9 shows a split collar, in which the ends of the bolts are placed in a recess, so that there is no projection on which a man might be caught.

Guard for Counterweight of Radial Drilling Machine—The counterweight which balances the spindle of a radial drilling machine, is usually suspended in such a location as to endanger a workman in case the chain supporting it should break. The weight shown in Fig. 10 is protected by a heavy steel plate placed underneath it, which is strong enough to hold it in case the weight should fall, and the sides are inclosed with woven-steel mesh, so that a man could not get his fingers under the weight and have them pinched.

One of the standard signs forbidding oiling, wiping, repairing, etc., will be noted on the post, back of the machine. This machine is shown without any gear covers, and that is the condition in which it was received from the manufacturer. As a class, the makers of drilling machines have been slower to guard this equipment than any other kind of tool, presumably on the assumption that bearing which is above a man's head as he stands on the floor is not dangerous.

Wood Planer Safety Attachments—This tool has a "safety cylinder" which is a drum-shaped head, with the knives countersunk in such a way that only a thin slice can be removed at each stroke. If the operator's hand should be brought into accidental contact with this head when it is in motion, only a slight injury would be inflicted, whereas with the old type of square head, the entire hand would likely be chopped off at one stroke. As a further safeguard, the front portion of the knife is covered by a swinging guard held against the piece of wood by a spring and which automatically closes over the knife in front of the guide. An additional guard of similar construction is fastened to the back of the guide so as to protect the end of the knife at the rear of the table. Fig. 11 also illustrates a common type of guard for driving belts and pulleys.

Guard for Wood Saws—It is a difficult matter to get a satisfactory saw guard, since almost any arrangement causes more or less interference with the movements of the operator, impedes his view of the saw, and prevents the guide being brought close enough to the saw blade to cut off narrow edgings. The guard shown in Fig. 12 has a thin brass hood, so that it takes up very little room, and there are slotted openings through which a man can see the operation of the saw blade. It is counterbalanced by a spring, so that it raises easily when a piece of wood is pushed underneath it, and the use of brass prevents the danger of breaking the saw and throwing pieces of the steel blade in case the guard should come into accidental contact with the saw.

Safety Standards Are Beneficial

The agitation for the conservation of human life and limb is world-wide, and if a response is not made to this demand, in the way of intelligent and systematic provisions beforehand, conditions will be rendered more chaotic and unsatisfactory than they are at present, through the medium of hasty and ill-considered legislation which does not adequately meet the conditions, and which cannot be enforced without hardship to all concerned.

One manner in which this growing demand may be met, and by which the way can be paved for intelligent and constructive legislation for the protection of men working about machinery, is the determination and application of rational safety standards to the construction of new tools. This can be brought about by the voluntary adoption of such precautions by the machinery builders on the one hand, and by the insistent demand on the part of machinery users for equipment which has proper safeguards, on the other. The general adoption of some such standards as those described would aid greatly in bringing about this desired end, and would be mutually beneficial to both builders and users of machinery.

Anchoring New Bolts in Old Foundations

It is sometimes necessary to change an old foundation to accommodate a new arrangement of equipment. Whenever it is necessary to set an anchor bolt in an old foundation, the difficulty may be met in one of two ways, says R. B. Dale in *Power*. In the first method a hole is drilled in the concrete slightly larger in diameter than the bolt to be used and to the proper depth. A bolt is then prepared by cutting a slot in one end lengthwise of the bolt and about six or eight inches long. This slot is then fitted with a wedge of hardened steel held in place by a pin of soft copper or other soft metal. The bolt is lowered into the hole and struck several hard blows on the upper end with a heavy hammer. This shears the soft metal pin and drives the wedge into the slot, thus enlarging the diameter on the bolt at the lower end. The bolt is then grouted into the hole and the nut is tightened to complete the work.

In the second method a hole is drilled for the bolt as before. A second hole is then drilled laterally through the side of the masonry to meet the first hole and this is enlarged sufficiently to take the standard anchor plate. The work is completed in the customary manner, precautions being taken to grout the anchor plate to a firm bearing in the old concrete. The first method is cheap and simple, although there is no certainty as to what happens in the bottom of the hole. It also has the disadvantages of the grouted bolt previously noted. The second method, while it is more troublesome and expensive, is the more reliable.

Making Worm Gears in Great Britain

By I. W. Chubb

Methods of cutting the wheels, using roughing and finishing hobs. The worms are ground and polished after hardening.

Specimen drawings and shop sheets show how information is sent to the manufacturing departments.

The firm of David Brown & Sons, Ltd., Lockwood, Huddersfield, England, has, for a number of years, specialized in the production of worm gears. On general lines the process of manufacture is that which is well recognized as current practice, the worm being milled, case-hardened, ground and polished, and the wormwheels hobbed. But, while the general method is that commonly known, all the processes are differentiated from current practice by special devices or appliances which the firm has originated.

Practice has naturally given it considerable knowledge on the design and operation of these gears, and the extent of the firm's operations will be understood from the statement that it carries a stock of hobs numbering more than 1500. With the hobs in stock, about 90 per cent. of the orders usually received can be executed without delay; for special work the stock is added to at the rate of half a dozen hobs a week.

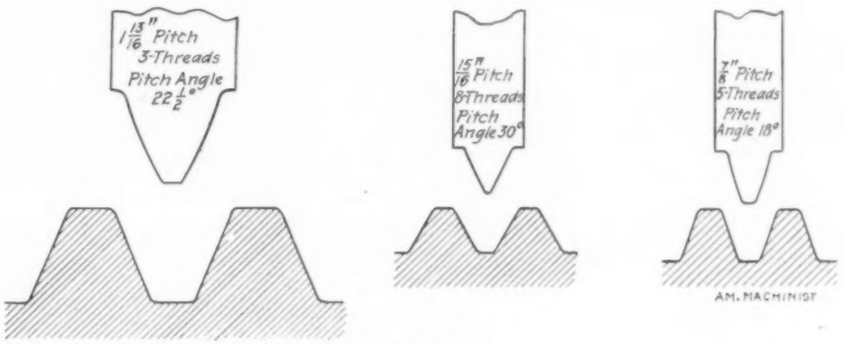


FIG. 1. GENERATED CUTTER SHAPES FOR WORM THREADS—HALF SIZE

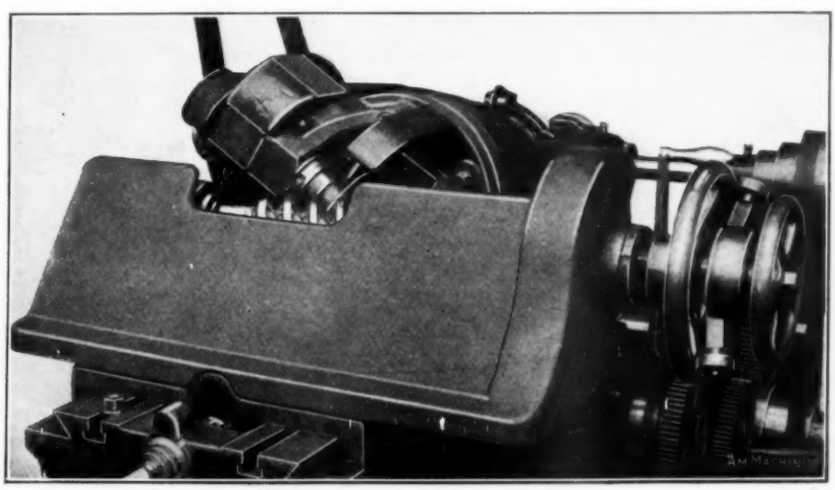


FIG. 2. METHOD OF GRINDING WORMS

Three-quarters of these are of high-speed steel, ranging from a single-thread hob ¾ in. in diameter to a multiple-start hob, 11-in. pitch-line diameter, 4-in. pitch, weighing 300 pounds.

Some of the hobs in stock have as many as 40 starts, and the firm has in process of making 20 hobs with from four to eight starts, and three other hobs with 15, 19 and 42 starts, respectively.

FOUNDRY PRACTICE ON THE WHEELS

Naturally the foundry is the starting place for the processes connected with wormwheels. Phosphor bronze, made to the firm's own specification and tests, is the standard material. Usually castings are rough machined the day following that on which they are made, this enabling the foundry to be informed at once of any defect. Some time ago tests were made on various materials and, as they illustrate the importance of correct selection, a reference to them is given.

A casing was made, and the worm and wheel shafts were fitted with ball journal and thrust bearings. The worm was connected by an ordinary flange coupling to the armature shaft of a motor running at 1000 r.p.m. The worm was case-hardened, glass hard, and ground on the thread to get a true, uniform, polished surface. The first sample was run for 75 hours continuously, with the exception of stoppage for a few minutes every 12 hours for inspection. After the first 75 hours it showed signs of pitting; the stoppage then lasting not more than five minutes. After a further 75-hour run, with stoppages at 12-hour intervals for inspection, it was found that the pitting had increased to cover about one-third the tooth surface, while the teeth had worn 0.015 inch.

In the second sample, a bronze of much higher tensile strength, the wear was very rapid and the temperature rose too quickly for any reliable data to be obtained. The third sample, of much

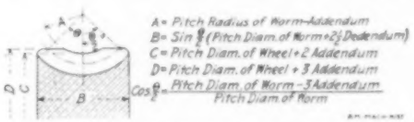

A = Pitch Radius of Worm-Addendum
B = Sin θ/2 (Pitch Diam. of Worm + 2½ Dedendum)
C = Pitch Diam. of Wheel + 2 Addendum
D = Pitch Diam. of Wheel + 3 Addendum
Cos θ/2 = Pitch Diam. of Worm - 3 Addendum / Pitch Diam. of Worm

FIG. 3. WORMWHEEL RIM FORMULA

lower tensile strength, also wore rapidly and after 50 hours was ⅛ in. thin on the pitch line. A fourth sample, again of low tensile strength, ran 180 hours without any appreciable wear, the machining marks remaining.

Three further samples of somewhat higher tensile strength ran about 150 hours and, though inferior to the fourth sample, wore a little better than the first. An eighth sample was made of the same mixture as the fourth, but specially treated, and this ran for 300 hours, the wear on the pitch line being 0.005 in. The power transmitted by the motor was 20 hp. to commence, but in the fourth and eighth cases it was gradually increased to 50 horsepower.

The castings are made in baked molds with special linings, no green-sand molds being used. Obviously importance is attached to the temperature of pouring. Under working conditions the properties of the material are not destroyed and, as in other cases, if the worm and wheel at the commencement of the run do not make good surface contact, they will gradually bed themselves without harm.

By the firm's special methods of finishing both worm and wheel, the maximum tooth bearing is obtained at the commencement. This can be tested in the or-

dinary way with the gears mounted as they will run.

For the worms, after a series of tests, three brands of case-hardening steel have been adopted, the only difference being in the tensile strengths. A material is used with which avoidance of distortion in hardening can almost be guaranteed and, of course, a glass-hard surface after finishing is obtained.

Turning and Hobbing the Wheels

The wheel blanks in the form of castings, when tested and examined, are transferred to the wormwheel turning department. If a large number of wheels is wanted on one order, the work is transferred to the automatic department. In turning the wheels, special care is taken that the register is correct and the face true, as this is bolted to the mounting flange. After turning, the wheel blanks proceed to the hobbing department, the next operation being to rough out with a machine-relieved taper hob. This has teeth which are specially thin and the angle is slightly less than the worm, so that a small amount is left on the wheel threads for finishing.

The hob is machine-relieved in the usual way, but before it is removed from the relieving machine, each end is faced and a boss, from $\frac{1}{8}$ to $\frac{3}{16}$ in. wide, is turned to a definite diameter. After the hob has been hardened to set it true in the grinder to grind out the bore, the boss on one end is fitted into the register of a hardened faceplate, which fits the grinder spindle. Thus the hob is set true with the relieving, the boss on the other end fitting into a special steady rest. Special accuracy is claimed for this method and, in fact, the firm considers that it is not possible to set any relieving cutter true from the top of the teeth. The first hobbing process is but the roughing cut.

For finishing, a special form of hob has been devised, so that practically continuous milling cutting is obtained. An ordinary hob, machine-relieved, is reduced in diameter when sharpened, and, in fact, after several sharpenings loses its size, giving a different bottom diameter and angle to the thread than at first. The cutting face should be radial, and though this cannot be guaranteed on the grinder by the generating process employed, it is obtained in the firm's hobs. Only a small amount of metal is removed by the finishing hob, and the face of the tooth presents a burnished appearance. Very little heat is generated with the finishing hob, so that distortion due to that cause is minimized.

With the use of this hob the full bearing surface is obtained without any bedding between worm and wheel, provided they are at the correct center distance. In fact, it is claimed that with this system of finishing, it is possible to produce wormwheels quite interchangeable and to the finest limits. In one order, amounting to several hundred sets, a guaranteed variation of not more than 0.002 in. in center distances has easily been met.

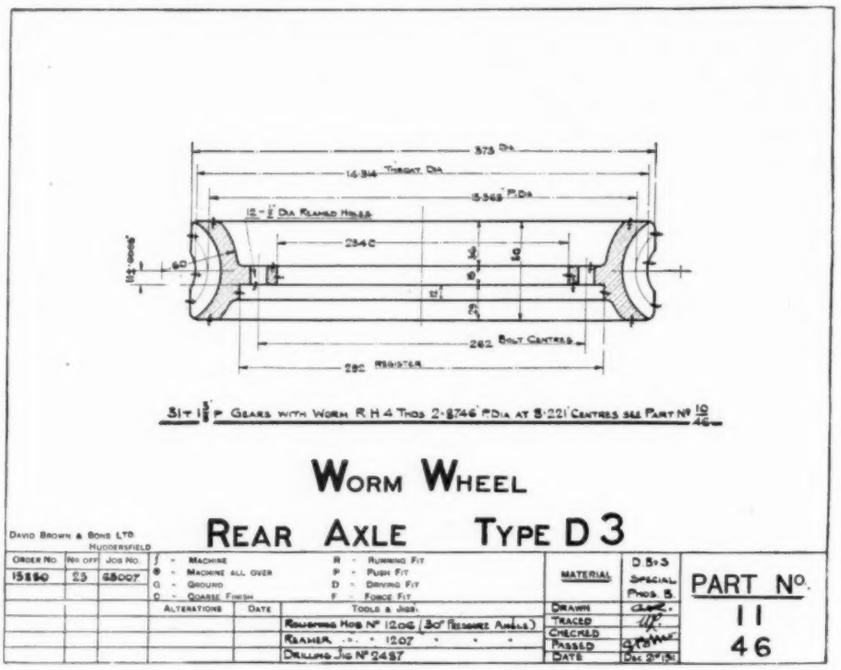


Fig. 4. Typical Drawing of Wormwheel

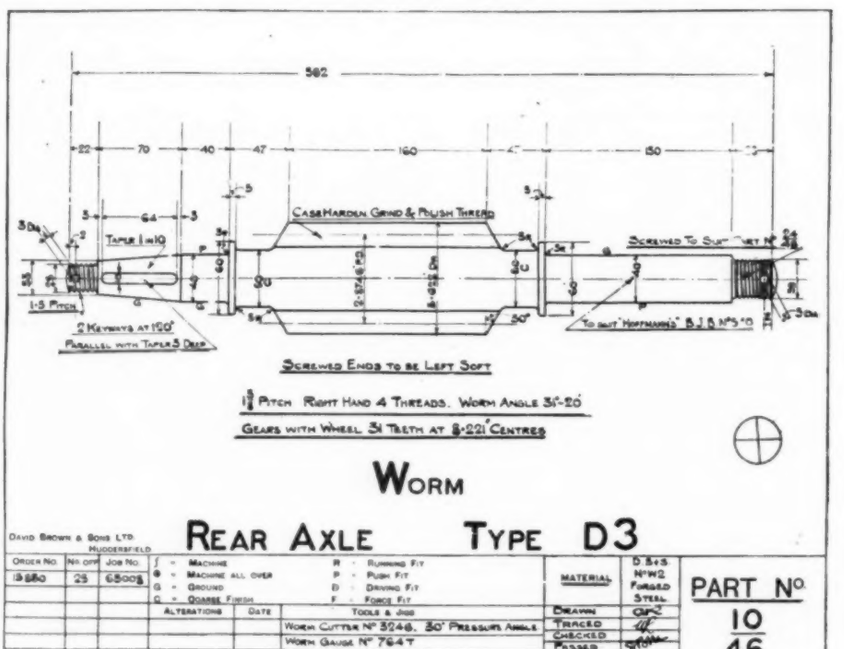


Fig. 5. Another Typical Drawing of Worm

Some of the hobbing machines used are of the well known type, but most are special and of the firm's own manufacture and design. Micrometer gages enable the operator to set either a roughing or finishing hob at the correct distance from the face to which the wormwheel is bolted, so as to insure central position for the hob. A ball micrometer caliper with swivel end is used for measuring the wheels before they are removed from the machine, no matter whether the number of teeth is odd or even. This is of the greatest service both to shop foremen and the inspection department. The finishing hob can be sharpened any number of times, but never loses its diameter.

Cutting the Worms

Worms are produced either direct from the bar or from special forgings, according to the class of job. When the worms have been rough-turned, they are taken to the grinding department, where the

outside diameter is ground and also the shaft at each end. This is essential, as it is possible then to test the truth of the worms at every subsequent operation.

The worm is milled by a special cutter, the shape of which is generated. The drawing office specifies the pressure angle, diameter, pitch and depth of tooth. The required cutter forms can be produced on a special machine within an hour. Fig. 1 shows shapes of cutters for worm threads. For $\frac{1}{8}$-in. pitch, an eight-start worm of 30 deg. pressure angle has very little curvature on the sides, while bars to rest in the V of the thread. A third bar of the same dimension is placed at the top, and this is passed under an indicator which registers to 0.0005 in. Even when the threads are but rough cut, worms tested in this way show a variation on the diameter of not more than 0.003 in., which is regarded as satisfactory for roughing.

For holding the worms true, a special chuck is employed. This is used both for grinding and milling and can be operated with ease by a boy. Since it has been used, the firm has not known a worm to slip during the milling operation.

would cut below the case-hardening and the worm would be hard and soft in places. In the experience of the firm this is worse than a worm not ground at all, and it is to reduce the amount of grinding that extreme care is taken to get the exact form of thread in the first instance. If too much has been left on for grinding or if the distortion is excessive, the abrasive wheel may draw the temper of the worm where the cut is heaviest.

The worm-milling cutter is set for position by a protractor micrometer, so that both sides of the worm are uniform. After the grinding process, the worms are pol-

Rear Axle. Type D3.

WORM GEARS. Job No 63007

Date Issued Dec 21 — 1911 | Complete Order No 15880
Date Received Dec 19 — 1911 | Due for Delivery Jan-18 — 1912

Complete. Finished Thread

No. of Pieces.	Material.	No. of Teeth.	Pitch	Face.	Diameter	Bore.
25	D.B&S. Special Phos Bronze	31	1⅛"	80m.m.	14·314"	To Blue Print

Centres.	P.L. Dia. of Worm	Hand.	No. of Threads.	Lead	Normal Pitch	Angle.	Addendum.	Dedendum.
8·221"	2·8746"	Right	4	5½"	1·174"	31° 20'	·373"	·433"

Height of Boss above Rim } To Blue Print.
Height of Boss above Rim }
Distance through Boss 15 m.m.
Diameter of this Boss } To Blue Print
Diameter of this Boss }
Key Seat None.
These Job Sheets with above 63008
Standard of Finish All over. Drawing No. 11/46 Complete this Order 15880

REMARKS.

Pressure Angle = 30°
Roughing Hob No 1206.
Reamer Hob No 1207.
Drill and Reamer bolt holes to Blue Print, with Jig No 2487
To gear with worm job 63008 at 8.221" centres.

Inspector's Report
Date Despatched 191 Signature
Description of Package and Box No.
THIS SHEET MUST BE CAREFULLY KEPT & RETURNED TO THE OFFICE WHEN WORK IS COMPLETED.

Job No. 63007 Complete Order No. 15880.
Goods Ordered out 25 D.B&S. Special P.B. Castings From Foundry. Order No.
Goods Ordered out From Order No.
Goods Ordered out From Order No.

Received Pattern Shop 191 Sent to Foundry 191
Description of Pattern used
Fig 6
Weight of Materials

Perforated portion to be torn off by Storekeeper and returned to office with all particulars filled in

FIG. 6

Rear Axle Type D.3.

WORM GEARS. Job No 63008

Date Issued Dec 21 — 1911 | Complete Order No. 15880.
Date Received Dec 19 — 1911 | Due for Delivery Jan 18 — 1912

Complete.

No. of Pieces.	Material.	No. of Teeth.	Pitch	Face.	Outside Diameter.	Bore.
25	D.B&S. No W.2. Forged St.	Worm.	1⅛"	160 m.m.	3.620"	Solid on Shaft

Centres.	P.L. Dia. of Worm	Hand.	No. of Threads.	Lead.	Normal Pitch.	Angle.	Addendum.	Dedendum.
8·221"	2·8746"	Right	4	5½"	1·174"	31° 20'	·373"	·433"

Height of Boss above Rim } To Blue Print.
Height of Boss above Rim }
Distance through Boss 562 m.m.
Diameter of this Boss } To Blue Print.
Diameter of this Boss }
Key Seats To Blue Print.
These Job Sheets with above 63007.
Standard of Finish All over. Drawing No. 10/46 Complete this Order 15880

REMARKS

Pressure Angle = 30°
Worm cutter No 3246
Harden, Grind and Polish Thread. Hardening Process No 4
Shaft to be left soft where shown on Blue Print
Work to Newall limits
To gear with wheel 31 teeth, Job 63007 at 8.221" centres.

Inspector's Report
Date Despatched 191 Signature
Description of Package and Box No.
THIS SHEET MUST BE CAREFULLY KEPT & RETURNED TO THE OFFICE WHEN WORK IS COMPLETED.

Job No. 63008 Complete Order No. 15880
Goods Ordered out D.B&S. No W.2. Forged St. From Stock. Order No.
Goods Ordered out From Order No.
Goods Ordered out From Order No.

Received Pattern Shop 191 Sent to Foundry 191
Description of Pattern used
Fig 7
Weight of Materials

Perforated portion to be torn off by Storekeeper and returned to office with all particulars filled in.

FIG. 7

TYPICAL STANDARD SHOP JOB SHEETS

another for 1⅛-in. pitch, three starts, 22½-deg. pressure angle, has more than $\frac{1}{16}$ in. curvature. All three cutters generate a straight side involute worm thread.

According to the firm, a milled worm, even in the roughing operation, should have the thickness and form of teeth within a few thousandths of an inch of correct size, thus leaving a minimum amount for the grinding operation after hardening. When taken from the thread miller, the worms are gaged on a surface plate, on which are placed two parallel

After having been rough-milled, the worm is hardened and then tested for hardness and distortion. An appliance for stretching worms after hardening is used to insure that they may be true on the pitch line. It is here that the advantage is evident of having ground the worm blank all over when in its soft state, as any distortion can be located immediately.

When stretched, the worms are ground as shown in Fig. 2, and care is taken to leave the minimum amount for this process; otherwise, of course, the wheel

ished to a glass finish, and before being dispatched they are tested for correct center distance, etc. Finally, as regards processes, besides other tools, the firm has special machines under way for dealing with worms and wheels. The plant comprises a special wormwheel generator with the roughing and finishing hobs, worm miller with an attachment for generating the cutters, and a worm grinder with an appliance for generating the shape of the abrasive wheel, together with special testing machines and complete equipment of measuring tools.

Design and Standard Drawings

Having so far as possible standardized its methods of manufacture, the firm has drawn up various formulas, charts, curves, etc., which it finds serviceable. Fig. 3 illustrates this in connection with wormwheel rims. In design the firm recommends that the worm angle should be kept as high as possible, maximum 43 deg., and the rubbing speed of the surfaces in contact, as low as possible, having regard to the nature of the load, the length of run without stopping and the allowable temperature rise. Ordinary temperature rises are about 80 deg. F. after a run of four or five hours.

For automobile worm gears it claims to reach 95 per cent. efficiency easily, but the materials must be carefully selected and the design and lubrication must suit.

For worms the standard linear thread angle is 15 deg., but for automobile use this is considerably increased. The addendum for a standard depth of tooth is 0.3183 of the linear pitch, or 0.3183 of the normal pitch if the worm angle exceeds 20 deg. Similarly the standard dedendum would be 0.3683 pitch.

A useful formula used for determining horsepower transmitted by the worm gear is:

$$Hp. = \frac{\left(K \sqrt{D} \times d \tan. \frac{\theta}{2} \times \begin{array}{c} tangential \\ speed\ of\ pitch\ line\ of\ wheel\ in \\ ft.\ per\ min. \end{array} \right)}{33{,}000}$$

Here the factor K is obviously of importance. It depends on the rubbing speed, the period of running and the nature of the load. For the other quantities D is the pitch-line diameter of the wheel, d the pitch-line diameter of the worm, and θ the angle of the face of the wormwheel. The tangential speed of the pitch line of the wheel in feet per minute equals the speed in revolutions of the worm multiplied by the lead in feet. The rubbing speed is the tangential speed of the pitch line of the wheel, divided by the sine of the worm angle. The tooth must be of a pitch strong enough to take the maximum pressure, but a small pitch is preferable to a large one, as the surface of contact is larger.

How the factor K varies is shown by three recent examples, where, in one case a phosphor-bronze wheel of 40 teeth, 1¼-in. pitch, 3¾-in. face, 15.915-in. pitch diameter, and a hardened-steel, single-thread worm of 3-in. pitch diameter, running at 1000 r.p.m., gave a tangential speed of 104.1 ft. a minute with a worm angle of 7 deg. 33 min., and a rubbing speed of 793 ft. a minute. Here for six hour rating K equals 165, but for intermittent running, as for hoists, K equals 265.

In a similar case, except that the worm has three threads, the tangential speed will, of course, be 312.5 ft. a minute, the worm angle 21 deg. 41 min., and for a six-hour rate K equals 150, or for intermittent running, 240. Again, with seven threads and a 2¾-in. face to the wormwheel, other dimensions as before, the tangential speed is 729 ft. a minute, the worm angle 42 deg. 51 min., and for six-hour rating K equals 96, or for intermittent running, 160.

Figs. 4 and 5 show the standard form of drawings issued to the shops for worms and wheels, while Figs. 6 and 7 give the corresponding work's job sheet. It will be seen that all the information needed by the operator is supplied in standard positions. It will be noted further that many of dimensions on the drawings are in millimeters.

Productive Relation of Engineer and Accountant

By C. J. Morrison*

The chief duty of an engineer is to furnish accurate economies, while the chief duty of an accountant is to furnish accurate records of the uses made of money and materials. These economies may be the construction of a dam to impound water to turn a desert into a fertile field, or the elimination of an unproductive motion in the manufacture of some staple article. No matter what the work, it is of the utmost importance that accurate, reliable and immediate records be kept.

Value of Timely Records

The records should be furnished at the earlist possible moment after the performance of an operation. Little use can be made of records that are merely history of events that occurred at some time so remote that all active interest in the event has been lost. By establishing close working relations between the account and the engineer and by combining the work of cost keeping and dispatching, it is often possible to secure costs almost as soon as operations are completed.

In one large plant using this system, a car was observed being loaded with machinery, and only a half hour later the complete cost of the machinery, including loading, was recorded in the office. If the charge for loading had appeared high, an immediate investigation could have been made. It is the same with other operations. When costs are known immediately after performance, action can be taken and remedies applied where necessary. For these reasons the engineer considers the promptness of the records of such vital importance.

In order to show the relations between the engineer and the accountant, it may be well to consider the requirements of the engineer and how they may be met. The engineer is interested in the payroll, not so much from the point of the present workmen, but those who are late or absent. For this reason he prefers an exception payroll where no attention is paid to those who are present and on time, but where a record is made of lates and absentees. Such a record reduces the clerical labor and gives at once the valuable information.

A study of these records often shows that a large amount of the lost time is occasioned by a few employees. In one establishment 85 per cent. of the absentees were 12 per cent. of the employees and 90 per cent. of the lates were among 10 per cent. of the employees. A pruning process soon reduced the amount of lost time. A standard payroll can be established for each department and by deducting the exceptions, the amount against which the daily cost cards must be balanced is determined.

Productive and Nonproductive Items

So, also, it is important to know the productive and nonproductive hours each day, and their ratio. When information is readily obtained, and the reasons for each nonproductive hour are shown on the records, it is possible to reduce this direct drain on a business to a minimum. In too many concerns little attention is paid to the nonproductive time, although it must be paid for, and is an element of the costs.

Materials should also be accounted for day by day in order that any excessive use or unnecessary waste may at once be checked. The records should also be so arranged that the stock will not only be kept up with the least possible clerical labor, but so that an excess will not occur. A perpetual card inventory meets these requirements very well. A comparison of the daily labor and material records will give the ratio between the two, which is, to some extent, a barometer of efficiency.

The engineer also desires a careful determination of the overhead expenses. These should be itemized so that each element can be carefully studied. It is not sufficient for the engineer to have simply a determination of the burden once a year, but he should know the daily charges against each item. With this information as a guide, large reductions can often be made in such items as light, heat, power, water and supplies.

Another valuable record is that of daily production. By production is meant the articles actually manufactured as distinguished from the quantity sold or shipped. A summary report covering all these items will give a valuable comparison between costs and production, and will show at once whether or not the plant is running on a profitable basis. When the accountant furnishes the engineer with records, as described, and the engineer uses the information to the best advantage, both become active producing factors in the business.

*Manager engineering department, Suffern & Son.

Making a Comptograph Type-bar

By Glenn Muffly

The special machine designed and built by the Comptograph Co., to roll the figures into the curved face of the type-bar. A small multiple-spindle drilling machine. Strength and torsion tests. Assembling and inspection stands.

Unlike a typewriter, the adding machine employs a type-bar on which ten characters appear, these being the figures 0 to 9 inclusive. Such a type-bar as shown in Fig. 1, presents many interesting problems in its manufacture.

When a key is pressed on the adding machine the type-bar for that column is moved to bring the corresponding figure into printing position, and a pawl engages one of the notches *A* to hold it in that position until the amount is printed and added into the total on the adding wheels, after which the type-bars are all released and brought back to their original position.

Type Must Be Light and Durable

It is necessary to have a hard, durable and sharp-faced type; to keep the spacing of type upon the bar very accurate so that alignment will be maintained; to mill or otherwise finish the notches *A* accurately and in a fixed relation to the figures on the type-bar *B* for the same

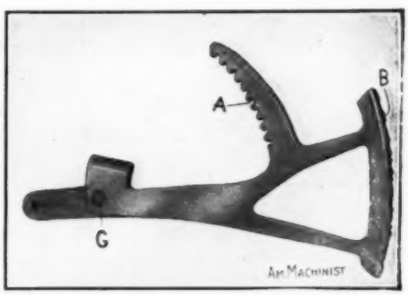


Fig. 1. Finished Typebar

reason; and at the same time to make the part thin and light without reducing its strength.

One of these type-bars is required for each column of figures to be added, or for each bank of keys upon the machine. In order to print the figures close together this means that the bar must be limited to ⅛ in. or less in thickness, and it was to accomplish all these points that it was decided to make the bar of one piece of crucible steel, roll the type faces, draw into shape, and harden it.

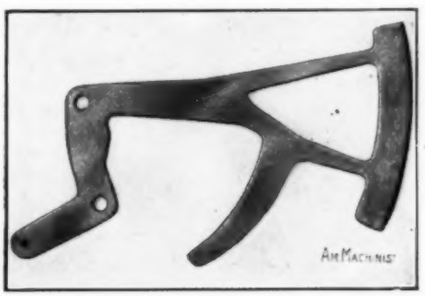


Fig. 3. The Blank

Each Type-bar Must Be Different

On the 16-bank machine, 16 different shapes of type-bars are required. All have the same type faces except that the bar in the units position carries a decimal point for each figure. In addition, there is an indicator type-bar carrying two special characters. The entire set is shown in Fig. 4 assembled ready to go into the machine.

Usual Method of Making Type-bars

The usual method of making type-bars for adding machines is to first roll the type on a straight bar as shown in Fig. 2, and after bending this to the desired arc, solder it to the body of the bar. The straight type-bars described are rolled sidewise, which operation could not be performed after the bar has been bent on so small a radius as that required.

While a one-piece bar is clearly better, the problem of rolling the type is a serious one, as it cannot be rolled sidewise and to roll it lengthwise in the ordinary way would stretch the bar, throwing the type faces out of alignment and probably spoiling the type in the process of manufacture by failure to register with the die or matrix after passing over it a few times. Die castings could not be considered, as the type face must be of steel to secure the required hardness.

After being told by the manufacturers of straight type-bars that the rolling of figures lengthwise on a one-piece type-bar was not practicable it was decided to make a machine to accomplish this.

Making the Comptograph Type-bar

First the steel 0.075 in. in thickness is blanked out in the shape required to form one of the 16 type-bar shapes as shown by Fig. 3. The next operation is to upset the bar slightly on the face at the point where the figure 0 is to be formed. This supplies the small amount of necessary extra stock on the end of the bar. Before the practice of upsetting was adopted some trouble was experienced with the 0, which was often imperfect on account of the absence of sufficient stock to draw from at the end of the bar. This was particularly noticeable on the bar for the units place with a decimal point after each of the figures.

Rolling the Figures

Now the bar is ready to roll in the special machine shown in Fig. 5. The piece is held in the block *C*, which prevents end stretch and causes the metal to flow out sidewise instead; this being the means of overcoming the one serious objection to rolling in this shape. The type-bar blank is clamped in the block *C* by means of the cap *C'* which is here shown removed. A quick means of bolting this cap in place is provided for with the swinging arm, slotted to receive the two heavy cap-screws in the block *C*.

Fig. 2. How the Figures are Made

Thus it is only necessary to loosen the cap-screws, swing the arm back and remove the cap without taking out the screws. The block *C* is geared to roll part way around as the ram *D* moves up and down, thus rolling the face of the type-bar against a straight matrix carried by the ram *D*.

By means of the tapered block *E* and the screw *F* the matrix or die is forced against the rotating type-bar with a pressure of several thousand pounds. The length of stroke of the ram *D* is 2½ in., and it makes 78 complete movements up and down per minute.

At each stroke the operator turns the

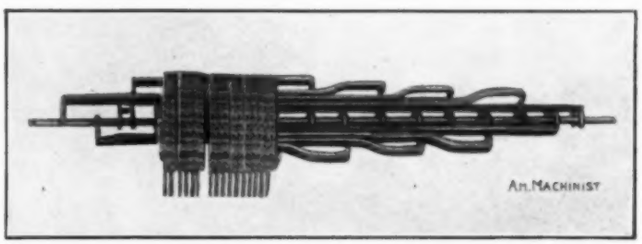


Fig. 4. Set of 16 Type-bars Assembled

handwheel upon the screw, forcing the wedge *E* down to bring the matrix die about 0.002 in. closer to the block *C*, as indicated by the graduations on the handwheel. This is continued for all but the last half dozen of the 35 strokes necessary to complete the operation. By one stroke is meant a complete movement of the ram down and up again. The last six strokes are made without moving the screw; this gives the type face a better finish.

During the rolling operation oil is dropped upon the type and the die, washing away small particles of steel and improving the finish on the type faces. The finished figures are about 0.025 in. high and in size are the same as ordinary pica figures on a typewriter. The length of the arc upon which the figures are rolled is about two inches.

Back of the rocking block *C* is a spur gear which meshes with a rack on the ram *D*. This rack is not crowded deeper into mesh with the gear by the downward feeding of the wedge *E*, and so may be kept very tightly meshed at all times, but to insure against possible lost motion in the machine a load is provided in the form of a weight suspended from the arm *W*. Between the gearing and the working parts is a wall which prevents any fine particles of metal from getting into the gearing and destroying accuracy.

Making the Matrix

The matrix die and a block similar to *C*, Fig. 5, which carries the original dies used in rolling the matrix die is shown in Fig. 6. The operation in rolling this matrix is naturally the reverse of the type-bar rolling operation but is done on the same machine. The matrix blank is placed in the usual position in the ram *D*. The substitute block *C*, carrying the steel figures, is set in the machine and the same operation as already described is gone through. The die is then hardened and is ready for use. The matrix dies thus made will roll 1000 to 5000 type-bars before they are discarded.

FIG. 7. TYPE-BAR AFTER ROLLING

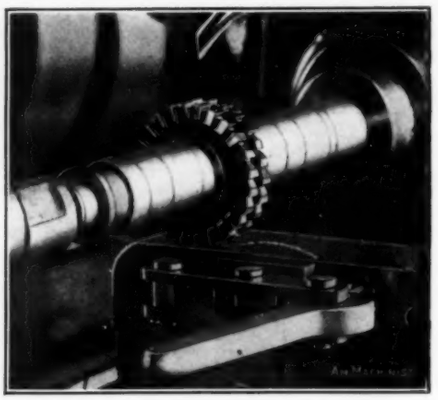


FIG. 8. STRADDLE MILLING THE TYPE-BAR

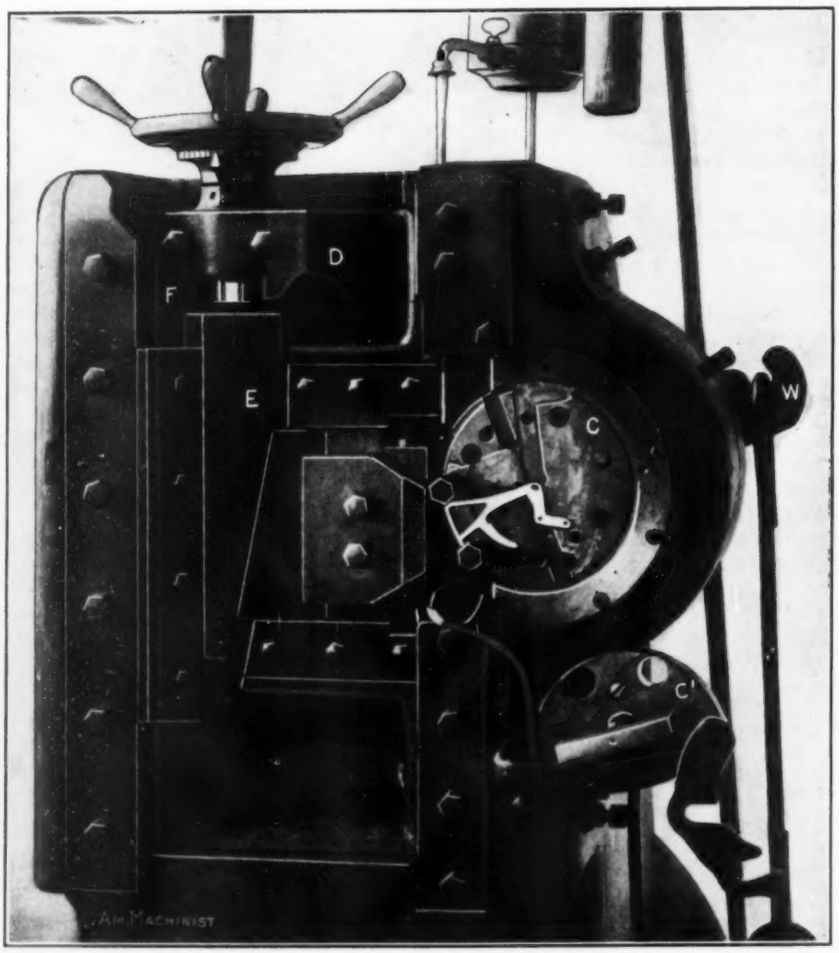


FIG. 5. SPECIAL TYPE-BAR ROLLING MACHINE

When the rolling operation is completed the type-bar has the appearance shown in Fig. 7, all surplus metal having been rolled out sidewise. This is milled off with a straddle mill as shown in Fig. 8, for which operation a special quick-clamping jig is used. The width is thus reduced to the finished size of 0.116 in.

Milling the Spacing Teeth

It has been found impracticable to stamp out the teeth, *A*, Fig. 1, so it is necessary to mill these, but a cutter small enough to be used on this work would be too small for good practice, so a special hollow mill is used in connection with the

FIG. 6. MATRIX DIE AND ORIGINAL DIE

milling fixture shown in Fig. 9. A crank moves the table lengthwise, feeding the part in against the small internal teeth of the milling cutter *H*, which forms one tooth at a time.

The fixture is arranged to pivot upon the point *G* of the type-bar as shown in Fig. 1 and the spacing of the teeth is accomplished by holes in a plate below the part of the fixture shown. The lever *I* withdraws a pin from one of these holes and allows the fixture to swing to a new position.

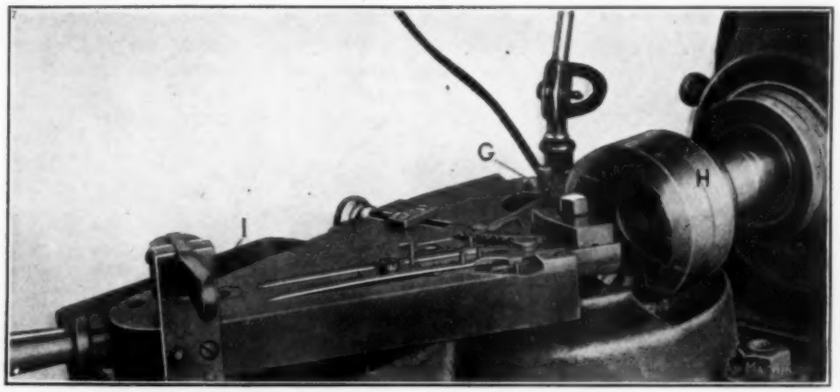


FIG. 9. MILLING INTERNAL TEETH OR NOTCHES

ASSURING ACCURACY

As it is quite important to maintain the proper relative positions between these notches and the figures which do the printing, a special indicating test gage is employed in discovering errors. This gage is shown by Fig. 10 as it appears when looking down from the top.

With the type bar in place, the indicating levers *J* and *K* are made to straddle one of the figures. Then the lever *L* is moved to bring the hardened point *M* into engagement with the corresponding notch as shown. When the type figure is in exactly the right position, relative to the notch, the two indicators *J* and *K* will register with their respective lines on the body of the gage. Any slight error that may be detected in this test is rectified with a special wrench, by means of which the inspector sets the teeth to the proper position.

Four other indicating points upon the same gage show every error that might affect the working of this part; the two blocks on the vertical standard are adjustable by means of holes and pins to fit the 16 various shapes of type-bars shown in Fig. 4.

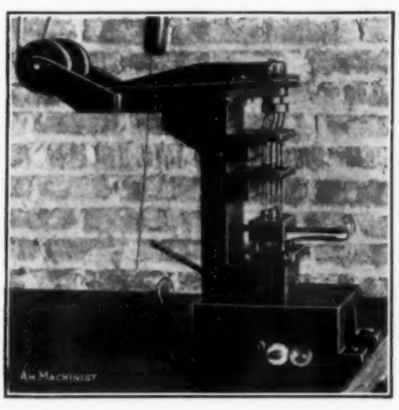


FIG. 11. SMALL MULTIPLE-SPINDLE DRILLING MACHINE

AN INTERESTING MULTIPLE DRILLER

A multiple-spindle driller is shown in Fig. 11. This press drives five drills from No. 52 to No. 60 in size, at a speed of approximately 2400 r.p.m. It is used in the manufacture of the small parts, two of which are shown at the base of the machine. These parts are known as pinion disks, and measure one inch in diameter.

The fixture shown upon the table of the machine is the jig for holding these pinion disks, and the feed is accomplished by means of a small hand lever which raises the work up to the drills. The drive is by a round twisted belt to the grooved pulley directly above the spindles. By employing an eccentric crank action the five spindles are all driven at the same speed without any gearing.

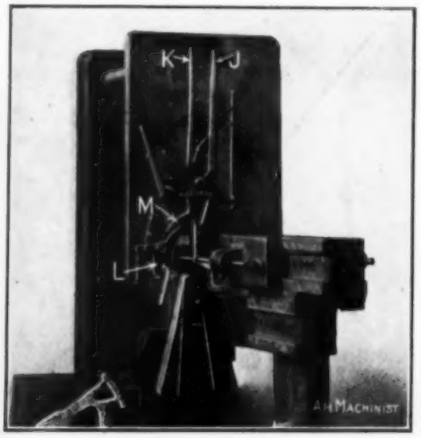


FIG. 10. TESTING REGISTER OF FIGURES AND TEETH

The upper plate to which the small cranks are attached has an eccentric movement equal to the throw of the cranks which are pivoted in it. The entire machine measures only 12 in. in height and weighs about 30 lb. Not-

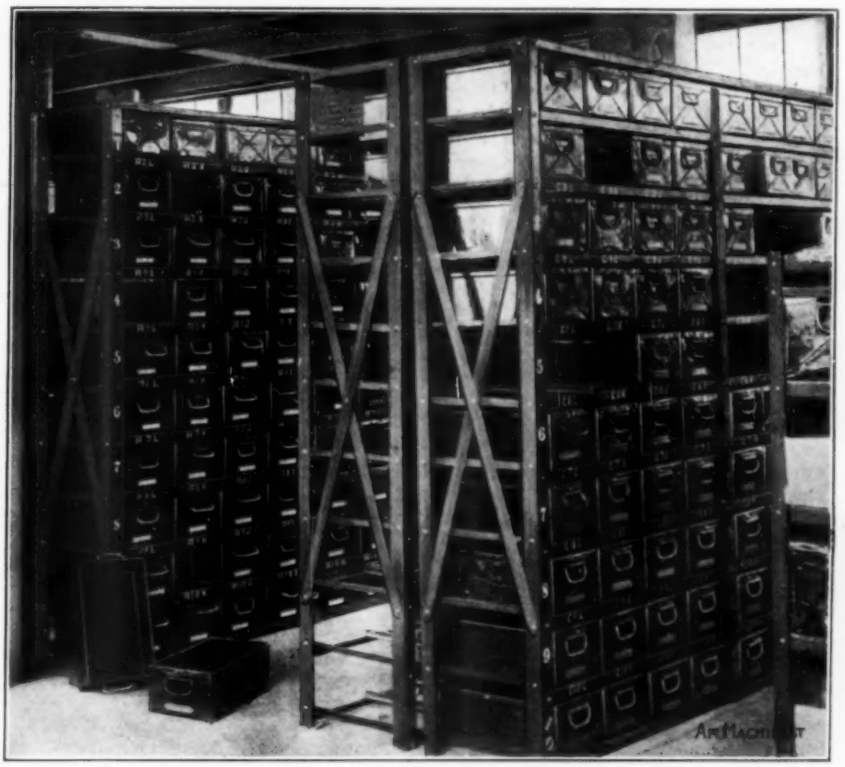


FIG. 12. RACKS IN STOCK ROOM

withstanding the small size of this tool, it is a big producer and shows a saving of 75 to 80 per cent. over previous methods of drilling these five holes.

Stockroom Racks and Tote Boxes

The style of racks used in the stockroom of this plant is shown in Fig. 12. It will be noted that steel is the only material used in construction, while the tote boxes take the place of bins. When any parts are required the entire box is taken out of the rack and carried to the assembling room. Likewise in the shop the box travels with the parts through all operations and the inspection room until the finished work is ready for the stockroom. Two of the boxes are shown on the floor from which it will be seen that there are handles on both ends, and on one end is a holder for a card giving the name and number of parts in the box.

Fig. 13. Inspection Department, Showing Inspection Stands

Assembling and Inspecting Stands

Typewriters, adding machines and other delicate complicated mechanisms require very careful inspection and adjustment, but it would not be good to roll the machine about on a bench while this work is done; they are moreover not the most convenient shapes to handle. Realizing that the work would be done in a more thorough manner and in less time if it were possible for the mechanic to get at it from just the right angles at all times, the stand shown in Fig. 13 was designed to make this possible.

These stands are used in the assembling as well as the inspection departments. The various positions shown illustrate the convenience of this device. A lever, operated by the feet, releases the arm and after swinging the adding machine around to the proper position for the next operation the stand is clamped in that position by a movement of the operator's foot. The hand lever *X* shown in Fig. 13 clamps the machine, after it has been revolved in a vertical plane, to the most convenient angle.

As adding machines pass from one department to the next in the processes of assembling, inspection and testing, the base *Y* goes with the machine. These bases are interchangeable on all of the stands used in the plant, and are made in two widths to accommodate the wide and narrow types of adding machines. A thumb-screw releases the base from the inspection stand and between operations the machines are stored in racks.

A sufficient number of the interchangeable bases is kept on hand, so that it is not necessary to remove the machines from the bases while waiting for the next operation, thus the base to which the framework of the machine is attached as it starts in the assembling department goes all the way through with that particular machine until it is cased in its regular casing after having passed all but the final operating tests.

Before the machines are cased, expert operators put them through a schedule of 174 specific inspection tests and make any adjustments that are found necessary. After the machines are locked up in their cases, they are removed from the inspection-stand base and turned over to the final-inspection department, where ordinary operators, not familiar with the mechanical details, put them through a series of actual working tests, keeping records on large manila envelopes in which samples of the actual work performed by the machine are preserved for future reference.

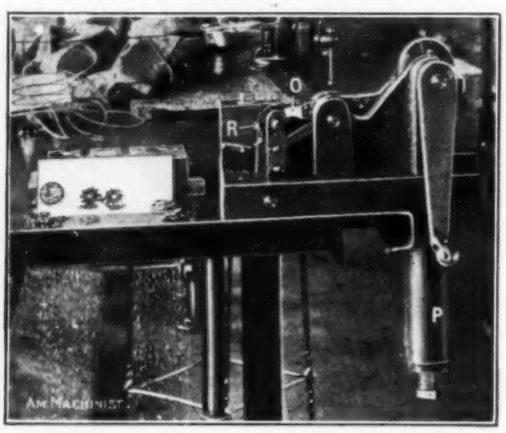


Fig. 14. Testing the Index Wheels

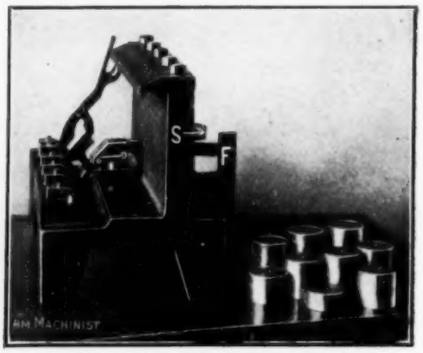


Fig. 15. Tail-piece Torsion Test

Strength and Torsion Tests

The method used in testing index-wheel teeth for strength is shown in Fig. 14. The index wheel is a stamped and hardened part, several of which are shown. The small teeth must stand a certain amount of stress, and in order to eliminate defective parts it is necessary to subject them to a fixed stress.

The operator places one of the wheels in the testing device and operates the crank, at each revolution of which the rocker arm *O* bears down upon one of the teeth. The amount of pressure depends upon the tension of the spring contained in the casing *P*. The eccentric which is revolved by the crank pushes down on the rear end of the rocker arm *O*, depresing the spring in the casing *P* while at the same time the pawl *R* releases the index wheel which is being tested, and allows it to rotate one tooth, bringing a new tooth in position for test.

There being ten teeth on the small index wheel, it is necessary to turn the crank ten revolutions for each part tested. This, however, is done very quickly and as the amount of stress thrown on each tooth is regulated by the spring and tension of the spring the speed at which the operator turns the crank does not affect the test.

Another interesting test apparatus is

the torsion gage shown in Fig. 15. The tailpiece of the adding machine is, in use, subject to a certain amount of stress, under the weight of which it will deflect to a very slight degree. This deflection must be overcome to insure the desired degree of accuracy. But it is not practicable to add enough to the weight of the part to eliminate it, as this would make the mechanism too cumbersome. The stress is, however, constant, and it was therefore decided to compensate for this by subjecting the tailpiece to just this same stress while making the test.

The indicator gage shown is the result, and the weight *S* is put on at the point where the weight comes in actual use. At the right of the test gage will be seen a number of weights of various sizes for use on the different pieces, which are subject to different weights in actual use. The fact that the removal of the weight will cause a slight change in position of indicator finger *T* shows that a greater degree of accuracy is obtained in this way.

Obtaining Accuracy in Graduating and in Scraping

EDITORIAL CORRESPONDENCE

A very interesting graduating machine, which was built by the Rivett Lathe Manufacturing Co., Brighton, Mass., for graduating slide rests and similar work, is shown in Fig. 1. The work is fastened on the end of a spindle, as can be seen on the right. This spindle is moved by a ratchet motion through the worm and wheel shown at the back end. All the mechanism is originally driven through the shaft *A* by a pulley at the other end, the indexing motion being intermittent in order to allow the work to dwell while the cutting tool is making its graduating stroke.

The plate *B* is secured to the main shaft *A*, and contains pins which actuate the arm *C* so as to drive the cutting tool the required distance to make its stroke.

The plate *B*, moving in the direction of the arrow, moves the lever *C* by means of the pins coming in contact with the beveled lower end, the movement depending on the diameter of the pin. This makes it easily possible to secure any desired length of stroke by varying the diameter of the pin, and the various plates can be used so as to give any desired sequence of operation.

With the plate shown, it will be noted that the lever has just returned after the passage of the pin *D*, which carries a large roller or bushing, and consequently gives a longer stroke than one of the plain pins. Then follows the regular strokes of the lever by the next four pins, which produce lines of the same length. Then comes the pin *E*, carrying a smaller bushing, so that the fifth division is a trifle longer than the first four. After this the four short strokes are repeated and the long stroke again appears, making every tenth division longer than all of the others.

A little careful study will show how very simple this machine is, how the cutting tool is held, and how the return is controlled by the two springs shown. The cutting tool *T* is simply a piece of drill rod ground to the proper shape.

There has long been a controversy in regard to the necessity and the merits of scraping, as applied to finishing surfaces accurately. While during the past few years this has been confined mostly to flat surfaces, it does not require a very long memory to recall the time when many circular bearing surfaces were also scraped. In fact, this is still followed in many instances. The grinder, however, has made heavy inroads in this direction, until there is now comparatively little scraping done excepting on flat surfaces.

Whatever one's personal opinions may be on this subject, we must be guided by results, and it is quite an argument on the side of scraping to find that the machines built by the Rivett company may be said to depend almost entirely upon scraping for their accurate results.

On the different machines built by this company, the amount of scraping is largely in excess of that usually found, which emphasizes the other side of the question and apparently leaves it for the planer and surface-grinder men to show that it is not necessary.

Nor can it be said that it is because the lathes are built in small quantities, for they go through in lots of approximately 100 each, some idea of this being secured from Fig. 2, which shows a group of headstocks waiting to be assembled.

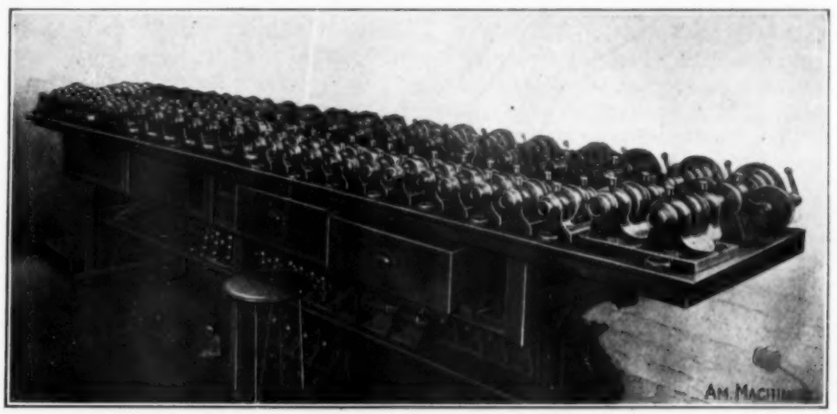


FIG. 2. LATHE AND GRINDER HEADS READY TO ASSEMBLE

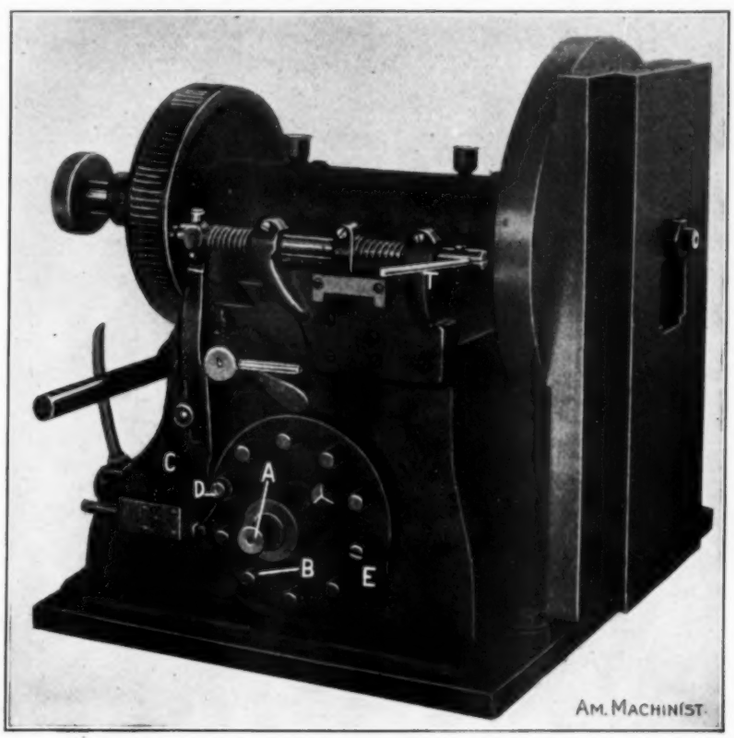


FIG. 1. CIRCULAR GRADUATING MACHINE

Making Needles for Talking Machines

By Fred H. Colvin

An industry in which modifications of old implements and methods give enormous outputs and a product of fine quality.

A hardening room in which producer gas is used for fuel.

The whole process may be summed up into grinding, hardening and polishing, in which more depends on the "know how" than on the apparatus employed.

Although we have become accustomed to hearing reproductions by talking machines of everything from ragtime to grand opera, we can hardly realize the number of these machines that are in use. When we further stop to consider that the needles in question are only used on the disk machines, it is little less astounding to learn that the normal output of needles in this country is from three to five million per day.

We are informed that there are but three factories engaged in this work at present. The illustrations which accompany this article were secured from the shop of John M. Dean, Putnam, Conn., which has a capacity of about two million needles per day, in addition to a large variety of other needles, such as are used in the various kinds of textile machinery.

A good grade of steel wire is used for making these needles. It comes from the steel mills in reels, and first passes through the straightening rolls as in almost any wire-forming industry, after which it is cut off to convenient lengths in the same machine. The diameter of the wire varies, four sizes being in general use, beginning with 0.026 in. for the soft tones, and running up to 0.06 in. for the larger needles.

The tone produced depends on the diameter of the needle, the distance it projects from the holder on the sounding box and the way in which its point is ground. A needle of large diameter and having a short stub point transmits practically all of the vibration produced by the indentations on the record to the sounding box, and delivers a loud tone from the machine. On the other hand, the needle of small diameter, ground with a long point, absorbs much of the vibration before it reaches the sounding box, and the tone produced is very much softer.

Between these two extremes it is possible to produce a large variety of needles to give almost any desired tone to the reproduction, the main object being to use the kind of needle having the tone suited to the room in which the machine is to be played. In addition to the different diameters given, the length of the point usually varies from $\frac{1}{8}$ to $\frac{7}{16}$ in., and in some cases includes two different tapers in order to secure the desired tone.

Grinding the Points

After the wire is cut off into suitable lengths, it goes to the pointing machine, of the type shown in Fig. 1. This consists primarily of the grindstone *A*, the feeding wheel *B* and the driving mechanism *C*, which comprises a simple worm gear driven by the pulley *D*, operated by a belt coming from the line shaft. The grindstone is independently driven, and, as will be noted, has its face turned to a curvature which corresponds to that of the feeding wheel *B*.

The operator takes a handful of these long wires, evens up one end by holding them in a vertical position and allowing the wires to settle evenly on a smooth plate. He is then ready to feed them into the machine. A stop is provided at the other side of the feeding wheel, so that the wires will project a uniform distance in front of the feeding wheel, as seen at *E*. This wheel is covered with rubber, so that as soon as the wires, which are to be converted into needles, are caught between this and the curved form underneath it, they are rolled across the face of the grindstone, being revolved many times during the passage, owing to their small diameter as compared with that of the feeding wheel.

A single passage across the face of the grinding wheel leaves the wire with a very fair point, if the gage against which the ends of the wire stop, has been properly adjusted. This is, however, only the rough grinding, the needles being fin-

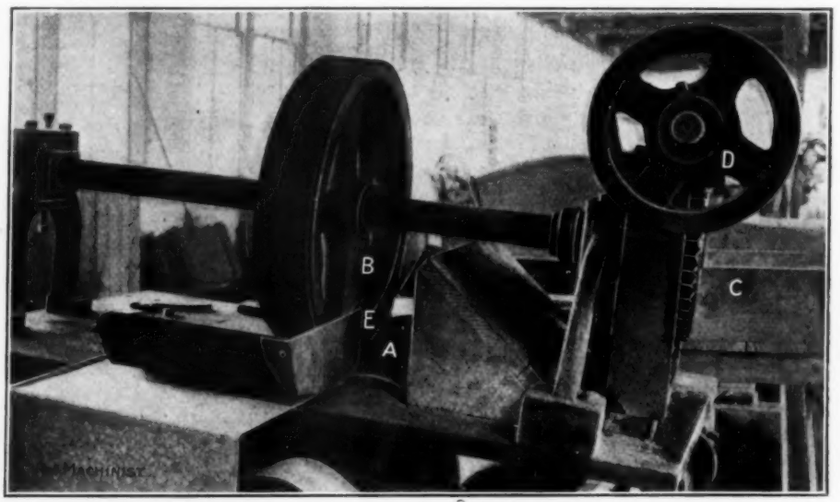


Fig. 1. Grinding the Points

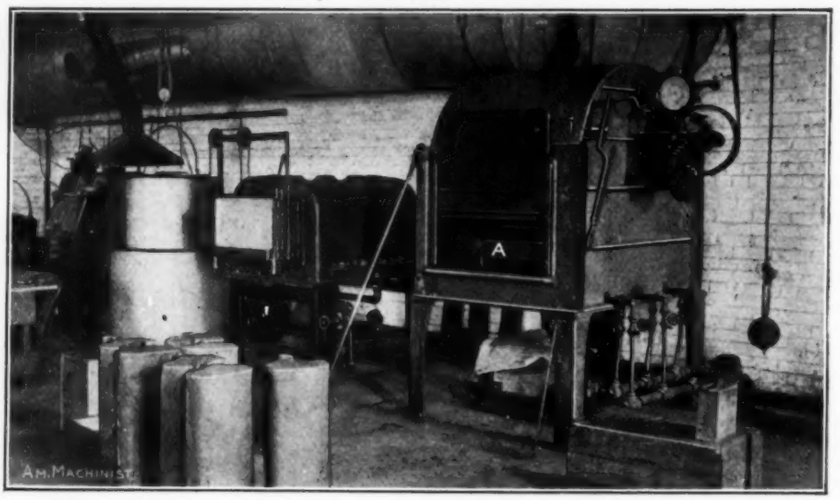


Fig. 2. The Hardening Room, Using Producer Gas

ished on other and similar machines. It will readily be seen how easy it is to change the angle of the point, or to make a double angle if desired, although this requires two passages across the face of the grindstone.

The whole upper surface or table, which carries the feeding wheel and its driving mechanism, can be tilted through a limited angle, in order to secure any desired form of grinding on the needles. It will also be noted that the large diameter of the grindstone and the short length of the taper, leave this practically straight.

After one end of the wire has been ground, the wires are reversed and the other end ground in the same manner. After the second or finish grinding, the wires go to the cutting-off machine, and the ends are cut off at the proper length to form the needles. This leaves both ends of the wire plain once more, and ready to be run through the grinder again, the operations of grinding and cutting off being repeated until the wire has become too short to handle or be fed by the wheel *B*. Men and boys become so expert in handling these needles that the wires go through in almost a continuous stream, which explains why it is possible to make a million needles per day with a comparatively small equipment.

Hardening with Producer Gas

The next step carries the needles to the hardening room, which is partially shown in Fig. 2, and is splendidly equipped in every way. As may be judged from the equipment, this company makes a large variety of other needles, some of the textile needles being approximately 8 in. long and ¼ in. in diameter, and having very long tapers ground on them.

An interesting feature of this hardening room is that the producer gas from the same plant operating the engines is used, and, after securing the proper adjustment of furnaces, excellent results are obtained with it. It is also interesting to note in this connection that the company has found it extremely reliable as an isolated power plant, neither the gas engine nor the producer gas having given as much trouble as was previously experienced with a small steam-plant equipment.

The machine in the foreground is for drawing the needles to the proper temper, and consists of a rotating mechanism on the inside, which carries the pans shown standing on end in the foreground at the left. One of these pans is shown in position inside the furnace at *A*, the inside mechanism, driven by the worm gearing shown under the barometer, carrying these pans over the heat and allowing it to be evenly distributed so as to secure a uniform product.

As with all hardening and tempering operations, this leaves an oxide or scale on the work, which must now be polished both for the appearance and to present as smooth a point as possible to the record on which it is used.

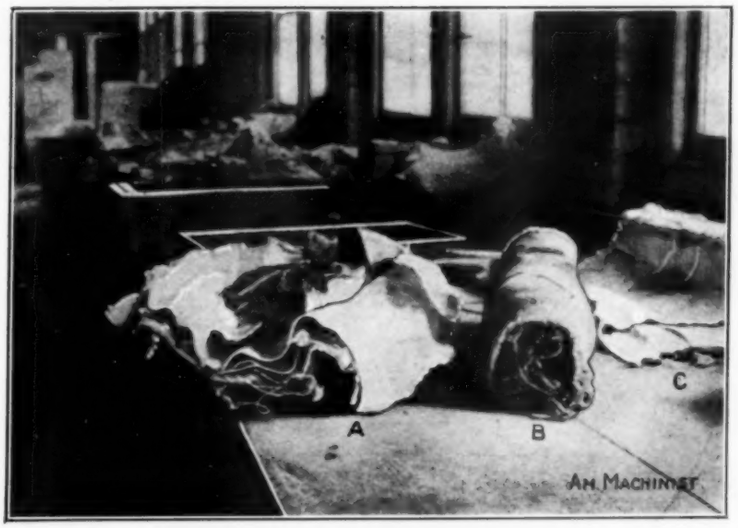


Fig. 3. The Canvas Rolls for Polishing the Needles

Old, But Satisfactory Polishing Methods

Although many methods have been tried, none has proved so satisfactory as the old plan which has been in use about as long as needles of any kind have been made in any country. And while the method seems crude in the extreme, there can be no question as to its producing the desired results at low cost. The principal objection seems to be that these machines require considerable space for their operation.

A zinc-lined trough, which is practically half a hexagon, is laid on the bench, and over this are placed several thicknesses of canvas, as can be seen at *A*, Fig. 3. Into the depression formed by the trough underneath, which acts as a form in this case, is placed a pile of needles, say, two quarts, as it is difficult to describe the quantity in any other way, and the canvas wrapped around them and securely tied, as shown at *B*. Before this

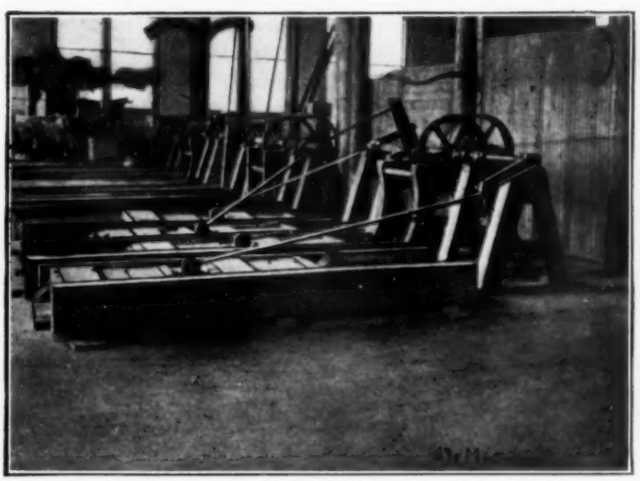


Fig. 4

Fig. 5

Two Views of the Machines Which Polish the Needles

is done, polishing material is placed in with the needles and the rolls taken to the polishing machine, shown in Fig. 4. The canvas at *C* shows a wrapping ready to be filled.

These are very simple machines, and consist of a driving mechanism having an A-frame, which carries the driving shaft and the long crank arm for driving the polishing blocks back and forth in their beds. These have a movement of perhaps 30 in. The beds in which they move are simply to prevent side movement, and also form a support for the rolls of the needles being polished. The ease with which they can be disconnected from the cranks can readily be seen in Fig. 5.

Two or three of these prepared rolls are placed under the heavy polishing blocks and the machinery is started. The blocks are heavily weighted, according to the needles being polished, and travel back and forth, rolling the needles in the canvas and requiring almost no attention.

Cooling Off the Rolls

After they have been rolled for a given length of time, each roll is removed and cooled off by a rather peculiar method. A blunt-ended punch of perhaps a half-inch in diameter, is driven into the roll through the canvas covering at two or three points and possibly a pint of water poured in through these holes. As the holes are made by forcing the fibers apart instead of cutting them as with a punch, it is comparatively easy to practically close the holes by working the fibers back into place, and the rolls are against placed in the polishing machine for the completion of the operation. On coming from these polishing machines, the needles are in splendid condition, being very brightly polished and exceptionally smooth, in spite of the rather crude way in which the desired results are secured.

All that now remains is to count out the needles by weight and put them in proper boxes for distribution to dealers and users. Many of the needles are made for dealers, and the packages bear individual imprints. They are generally put up very neatly and are generally sold at a remarkably low price to the consumer. A few of the needles made for both talking machines and other purposes, are partially flattened after being ground. In the case of the talking-machine needle, this makes it more flexible when used with the flat side toward the record and very stiff when used the other way. This is practically a two-tone needle, producing either a loud or soft reproduction with the same needle.

Poor Force Fit Design

By Curtiss F. Smith

The construction shown in Fig. 1 is that of a hydraulic shear with a stationary top knife, the under knife drawing up. The operating piston *B* is acted upon by a hydraulic pressure of 550 lb. to the square inch. The yoke *A* sets over the top of the cylinder *B*, and, by means of the rods *EE*, raises the lower gate, to which is attached the knife. The piston *C* is a pull-back, and and is attached to the cylinder *F* by a top yoke and rods. During the cutting stroke there is no pressure in *C*.

To insure the return of the yoke, rods, gate and knife by other means than their own weight, the yoke *A* is forced onto the neck of the piston *B*, at *M*. This construction is open to criticism.

The actual cutting work is very easy for the parts as designed, and the pressure, but at each cut the piston is allowed to reach the limit of the stroke under full pressure, the stopes being at each side over the gate below, which carries the knife. Consequently the yoke and rods have to take the maximum stress which can be delivered by the hydraulic pressure. Assuming the yoke *A* to be a beam with two equal loads, and supported approximately at *x* and *y*, the greatest bending moment imposes a load of 2300 lb. per sq.in. across the weakest part, as shown by the irregular lines near the center, which indicate where the casting broke.

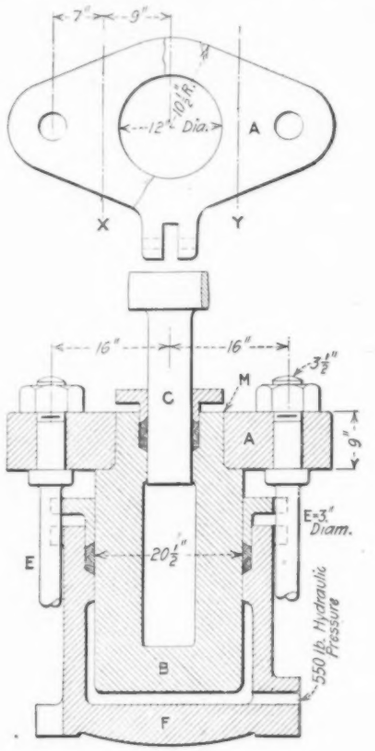


Fig. 1

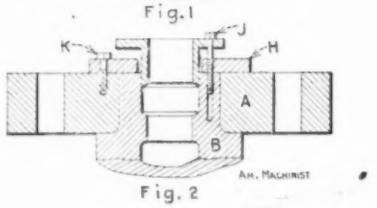


Fig. 2

Poor Force Fit Design

This load is safe for cast iron, of which the yokes were made. But what initial stress was there due to the force fit?

As designed, this construction called for a 60-ton force fit at *M*, which was certainly enough to pull the parts back against any sticking of the gate guides. Was 60 tons necessary, or was it one or two hundred per cent. more than would have been required as the parts were machined, or did it barely go on at 60 tons pressure?

After breaking the first yoke, 45 tons pressure was used on the next one; when that broke, 15 tons pressure was used on the third. The fourth was a steel casting pressed on with 20 tons pressure, and is in constant use.

The explanation, aside from the difference in tensile strength, is easy. Steel elongates under tension, cast iron practically does not. The cast-iron yokes were probably cracked by the force-fit pressure before ever installing in the shear, and a few strokes against the limit-stops served to complete the rupture.

As this construction was not necessitated by space or design, the construction shown in Fig. 2 would have been better. Here the yoke *A* is an easy fit over the neck of the piston *B*, and is retained by means of a collar *H*, attached until the capscrews *K*, slotted to clear the gland screws *J*. In this case the gland would have to be of an additional length equal to the thickness of the collar *H*.

This last steel yoke has been in use for some time, and no trouble is anticipated, but should it ever break, the construction illustrated by Fig. 2 will be used, which will eliminate this trouble forever.

The average man's conception of distance and speed receives a severe shock when he delves into the mysteries of astronomy. Light travels at the astounding speed of 186,000 miles per second. In spite of this great speed, astronomers have observed light spreading out in a circle from a burning source. The observation was made when a new star—a nova—was discovered in 1901. A cold dark star, moving with great speed, had plunged into a huge mass of nebulous matter, and had burst into flame as the result of the collision. The light produced traveled out all around, and after, say, a hundred years reached the earth. Astronomers here then first observed the nova, and later they observed a nebulous ring of light spreading out round the burning star; after six months the ring was about a quarter of the moon's diameter, it gradually enlarged, grew fainter, and disappeared. This ring was simply the first brilliant outburst of light traveling through the nebula at the speed of 186,000 miles per second. The distances considered in astronomy are rather appalling.

A Modern Drafting-room System

By Grandon G. Gates

The details comprising this system have simplicity and the absence of red tape to recommend them. It is used for special machines as well as the regular product.

The drafting-room organization in use at the Goulds Manufacturing Co., Seneca Falls, N. Y., has been slowly developed along general lines for many years until a system has finally been perfected, which, in point of efficiency and thoroughness, leaves little to be desired. Naturally, in an industry of this character (the manufacture of pumps and hydraulic machinery) a large amount of the work going through the drafting department is of a special character, consisting of the fitting of various forms of drives, the alteration of gearing, special fittings, etc. A record of all of these special outfits must be accurately kept and it is intended to give here a brief description of the method in use, and also of the drafting room and its equipment.

Drafting Room Equipment

The drafting room extends across the entire north side of one story of the office building and about half way across the western side. Large windows at frequent intervals afford an abundance of light. The drawing tables are so placed that two desks face each other in front of each north window. To shut out the glare of the sun, and reflections, each window is equipped with a curtain of bleached muslin, which, while admitting an abundance of light, effectually softens it.

The artificial lighting consists of two 16-candlepower incandescent lights for each desk, mounted in a semi-cylindrical reflector, extending from the ceiling, and movable by means of a ball and socket adjustment. Another adjustment provides for vertical regulation. The general lighting of the room is done by 100-watt tungsten lamps. The drawing-table tops are 48x36 in. and are fitted with the well known parallel-rule attachments for the straight-edge. At the side of each drawing desk a smaller table is fastened, where drawings, etc., may be laid for reference, while extending down one side of the desk is a tier of drawers.

The chief engineer's office is just off the main drafting room, while the chief draftsman has a desk at one end of the drafting room. All drawings, reports, data, and anything of a valuable nature are kept in a large fireproof vault, opening directly off the drafting room, and to which all have access during the day.

There is the usual blueprinting apparatus, consisting of a continuous electric blueprinting machine, together with a washing tank, rollers, etc. The personnel of the engineering department consists of the chief engineer, the chief draftsman, draftsmen, a specification clerk and his assistant, and the blueprint boys.

General Classification

The various types of pumps and machinery manufactured are designated by figure numbers, and under the figure number, according to size, as Fig. 924, 5x8 in., indicating a pump with a 5-in. plunger and 8-in. stroke, of a type known as Fig. 924. A separate card, Fig. 1, for each size of every standard pump is kept in an index. This card, as will be seen, gives the location of the list of parts for the various constructions, as bronze fitted, regular construction, etc., the location of the standard dimension drawing and of the various outline drawings showing different forms of drive.

A complete list of all parts for every size of every standard pump is kept on a tracing, 9½x14 in., the location of which is at once evident from an inspection of the index card for that figure number and size.

As before mentioned, many of the orders are for pumps with special drives, gearing, etc., of which an accurate record must be kept. For this purpose, an index composed of cards like Fig. 2 is kept, which at once shows the location of all parts in connection with that order, as well as a general description of that particular outfit. Each draftsman makes out one of these cards upon the completion of an order, when it is filed according to figure number and size.

All orders received by the company are entered on a special form bearing a certain number, after which everything pertaining to that job is referred to that order number. All orders requiring work of any kind from the engineering department are at once sent to this department, where they are taken charge of by the chief draftsman, who issues them to the various draftsmen together with any necessary instructions. The chief draftsman keeps a separate card index for each order in his possession, indicating the disposition of the work, reason for being held up, etc. These cards are as shown in Fig. 3.

All work is under the general supervision of the chief engineer, assisted by the chief draftsman. The former looks after new designs, constructions, etc., while the latter is directly responsible for current orders, completion of work, its correctness, etc.

All draftsmen are supplied with a set

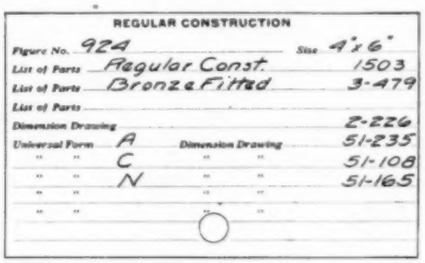

REGULAR CONSTRUCTION
Figure No. 924 Size 4"x6"
List of Parts Regular Const. 1503
List of Parts Bronze Fitted 3-479
Dimension Drawing 2-226
Universal Form A Dimension Drawing 51-235
" " C " " 51-108
" " N " " 51-165

Fig. 1. Regular Construction Card

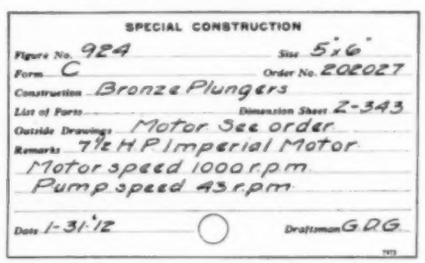

SPECIAL CONSTRUCTION
Figure No. 924 Size 5"x6"
Form C Order No. 202027
Construction Bronze Plungers
List of Parts Dimension Sheet 2-343
Outside Drawings Motor See order
Remarks 7½ H.P. Imperial Motor
Motor speed 1000 r.p.m.
Pump speed 43 r.p.m.
Date 1-31-12 Draftsman G.D.G.

Fig. 2. Special Construction Card

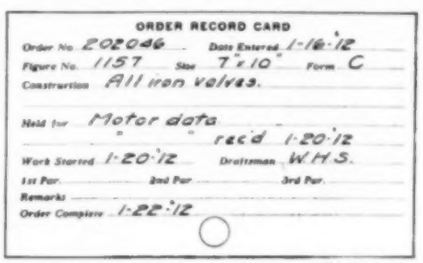

ORDER RECORD CARD
Order No. 202046 Date Entered 1-16-12
Figure No. 1157 Size 7"x10" Form C
Construction All iron valves.
Hold for Motor data
" " recd 1-20-12
Work Started 1-20-12 Draftsman W.H.S.
1st Par. 2nd Par. 3rd Par.
Remarks
Order Complete 1-22-12
AM. MACHINIST

Fig. 3. Order Record Card

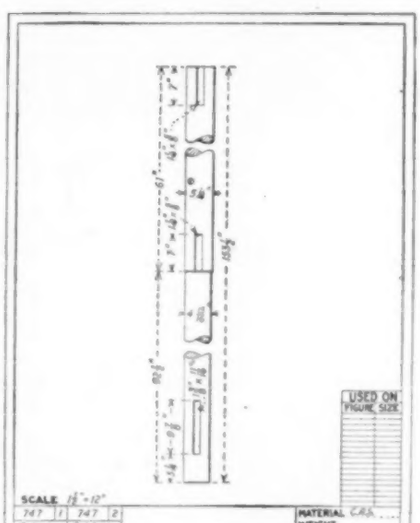


Fig. 4. Specimen Standard Drawing

of general drafting instructions with which they are expected to familiarize themselves. These instructions include directions as to sizes of standard drawings, types of lines to be used, various symbols for different machine and grinding finishes, symbols for various materials, and the different sectional shadings, together with directions for the use and keeping of the several card-index systems, filling in of drawing titles, changes made in drawings and numbering of drawings. In connection with these general instructions are charts showing the sizes of the various bolts, studs, setscrews, machine screws, etc., carried in stock by the shop, thus saving a man from specifying sizes other than standard.

In the working of the drafting room each man fills in time cards as shown in Fig. 9, to show the work he is on and the time taken. These cards are collected daily, looked over by the chief draftsman and sent to the cost department. In this way it is possible to know accurately the cost of the drawing time on every order.

DRAWING RECORD

1st ORDER NO. 202183 DRAWING NO. 7-364
TITLE Main Frame C.I.
FIGS. USED ON 1598 20"x20"
REMARKS Frame made right and left hand
PATTERN NO. 20937 DRAFTSMAN J.C.B.
DATE 1-31-12

Fig. 5. Drawing Record Card

DRAWING NO. 1034 DATE 2-1-12
RECEIVED BY SHOP C.H.D.
RECEIVED BY FOREMAN
ISSUE NO. 1 DATE 2-1-12
FOR ORDER NO. 202046
REMARKS 1 Print.

Fig. 6. Shop Blueprint Record Card

Drawing No. 56-35
Mr. C.W.F. Date 12-11-11
Please supply 4 prints of Fig 1585 5¼ x 12
Ordered for Am. Smelting and Refining Co
Order No. 200283
Ordered by J.B.A.
Passed for printing 12-12-11 C.W.F. Prints made 12-12-11
Rec'd by J.B.A. Date 12-12-11
REQUEST FOR BLUE PRINTS

Am. Machinist

Fig. 7. Requisition for Blueprints

THE GOULDS MANUFACTURING CO.
BILL OF MATERIAL

SHEET NO. [redacted]
SEE SHEET NOS. [redacted]
NO. REQ. [redacted] FIG. NO. [redacted] SIZE [redacted]
DRIVE [redacted] TEST [redacted] VALVES [redacted] PACKING [redacted]
COMPLETE BY [redacted] 19[redacted] BILL COMPLETE [redacted] 19[redacted] BILL INCOMPLETE [redacted] 19[redacted]
MOTOR [redacted]
MOTOR ORDERED [redacted] 19[redacted] RECEIVED [redacted] 19[redacted] REMARKS [redacted]

ORDER NO. [redacted]
BILL MADE BY [redacted]
CHANGES AND ADDITIONS

MONTH																					
DAY																					
SHEET LINE																					
ISSUED																					

	NAME OF PART	MATERIAL	PATTERN NO. OR SIZE	SHEET NO.	UNIT	NO REQ.	IN STOCK OR DATE DUE	ROUGH CASTINGS RECEIVED	BORING MILL	SLAB MILL	PLANER	LATHE	MILLER	GEAR CUTTER	DRILL	GRINDER	KEYSEATER		RECEIVED FINISHED
1																			
2																			
3																			
4																			
5																			
6																			
7																			

Am. Machinist

Fig. 8. The Bill of Material

Drawings

All tracings are made on one of three standard-sized sheets, 24x36 in., 18x24 in. and 9½x14 in. These sheets of tracing cloth are bought cut with the border and title printed ready for use. Fig. 4 gives an idea of the general arrangement of a standard drawing, this being a facsimile of a 9½x14-in. size. Only one drawing is made to a sheet. The title is arranged as shown, with letters ⅛ in. high. If, for any reason, a drawing is altered after having been sent to the shop, it is immediately reissued under Issue No. 2 (for the first change) and a new print sent to the shop with directions to return all copies of Issue No. 1.

The drawings are recalled from the shop by means of a form such as is shown in Fig. 10, which is filled in, and sent out with the new print. This reissuing is taken care of as follows: When a drawing is first made, it is spoken of as Issue No. 1, as is indicated by figure 1 in the little square directly after the drawing number in the lower left-hand corner under the word "scale" in Fig. 4.

Suppose it is desired to change the diameter of the pinion shaft shown from 5 to 5¼ in. A circle ⅛ in. in diameter is drawn to one side of the dimension to be changed. In the space under the drawing number which bears the date and the draftsman's initials, and which is known as the change column, another circle is drawn. The same number is then inserted in the two circles. The new dimension is placed on the drawing in its proper place, which in this case is 5¼ in.; while, after the circle in the change column is written, "was 5 in."

At the top of the second change column is now rewritten the number of the drawing and directly after it the number 2, in the square, as shown, while the date of the change and the initials of the draftsman making the change are inserted below, as before, and the drawing is now known as Issue No. 2. This reissuing can be repeated indefinitely, simply by drawing in more change columns.

All drawings requiring any pattern work are given a pattern number which appears on the casting. New numbers are given for any change of the pattern. In the lower right-hand corner of the drawing is placed the order number under which the job is done.

As before stated, all drawings are kept in the vault, where they are filed, according to size, in horizontal compartments and drawers. Each drawing bears a number referring it to a certain position in some drawer or compartment, where it is always to be found, unless in the possession of some draftsman, as no drawings are allowed to be removed from the drafting room.

For every drawing made, a drawing record card is filled out by the man doing the work; this is shown in Fig. 5. These cards are filed according to title, combining an easy and effective means of future reference.

A cross index of all drawings is also kept; it lists the tracings according to their drawing number. This record, as well as the record of all pattern numbers issued, is kept in books specially made for the purpose. The issuing of all pattern numbers, drawing numbers, and filing of cards, etc., is attended to by the specification clerk's assistant, who also attends to the sending out of blueprints.

After completing a drawing it is handed to the chief draftsman who checks it, and if O.K., turns it over to the boy to be blueprinted. If there is any pattern work in connection, a copy is at once sent to the pattern shop while, if the piece requires any special tools, jigs, etc., another copy is at once sent to the machine shop so that these may be in readiness upon receipt of the casting from the foundry.

Another card index system is kept for all prints sent to the shop, these cards

being as shown in Fig. 6. Cards are sent with every print to the shop where they are signed and at once returned to the office and filed. If a print is destroyed or returned the card is removed from the file. Thus all prints in the possession of the shop are at once accounted for.

All blueprints sent out through the mails, as by an inquiry through the sales department, are requisitioned by means of a "Request for Blueprints" card, from the drafting room, by the department desiring them. These cards are as shown in Fig.

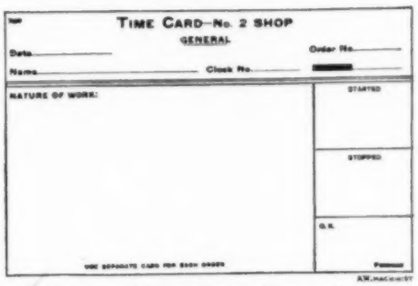


FIG. 9. DRAFTSMAN'S TIME CARD

7 and are made out in duplicate, one copy being kept on file in the engineering department and the other by the department making the requisition.

The original of the two cards is of thin paper so that one filling in, with a slip of carbon paper underneath, is sufficient for both cards. The stiff card is the carbon copy and is the one filed by the engineering department. Thus it can be seen at a glance whether a certain print has been sent in answer to an inquiry or an order.

Whenever a print is sent out that is other than a regular drawing or dimension sheet, as a dimension sheet showing some special drive, a duplicate copy is kept on file in the drawing room for future reference. This would be a drawing such as is indicated after "Dimension Sheet" in Fig. 2. The number Z-343 referring to a drawer known as the Z-drawer, where drawings of this character are filed.

In order to save the time of making a new drawing showing the dimensions and foundation layout for every special form of drive, skeleton tracings are made up and the proper dimensions filled in on the prints. All blueprints or dimension drawings which are sent in by outside parties for use with any particular order, are at once attached to that order, where they are always thereafter to be found.

SPECIFICATIONS

For all orders going through the engineering department, or for any new construction, change or design, a bill of material covering these special parts, or in the case of a new pump, covering the entire construction, is at once sent to the shop. The general construction of these bills is as shown in Fig. 8 and in the case of a special order they bear the name, pattern number, sheet number and number required, of all parts other than the standard parts. At the bottom of each such bill is then written "All other parts same as on regular list 1626," or whatever the number may be, the shop already having in its possession a bill covering the standard construction of a stock pump.

These bills are made up with the name

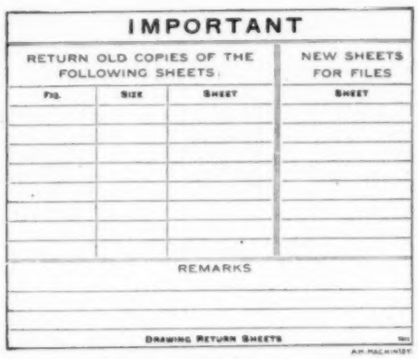


FIG. 10. FORM FOR RECALLING DRAWING

of all parts printed on them, leaving only the sheet and pattern numbers, and number required, to be filled in. They are on thin paper, so as to be easily printed, thus affording the shop an opportunity for filling in on the blueprint the blank spaces on the right-hand side. This work is attended to by the specification clerk and it is his duty to see that proper bills are sent to the shop as soon as possible for all orders coming into the engineering department.

To summarize briefly, the aim of the entire system is simplicity, to do away with all unnecessary red tape, and to provide a method of keeping track of work done and drawings made in as easy and comprehensive a manner as possible.

Two Inexpensive Bench Dies

BY F. J. BADGE

In jobbing shops, the tool makers are always under the necessity of improvising tools which must be quickly made and accurate. Cast-iron blanking and forming dies are not infrequent, and hard wood sometimes comes into use for bending dies. Often the cheapest way to produce a few small blanks in thin metal is by making a bench die, the hammer doing duty as a press.

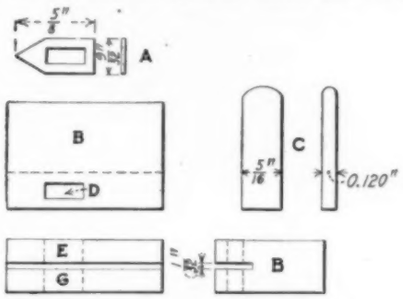


FIG. 1. AN INEXPENSIVE BENCH DIE

Such a die is shown at *B*, Fig. 1, and is made from a small piece of cold-drawn steel picked up from the scrapbox. The die was made to pierce a rectangular hole in thick tin, the outside of the blank being afterward trimmed with hand shears to the shape shown at *A*. The punch *C* was made from cold-drawn stock to the shape and dimensions shown, cyanided and hardened. A slot $\frac{5}{32}$ in. wide and $\frac{5}{32}$ in. deep was cut in the die *B*, and the aperture *D* marked off, drilled, filed, and finally drifted with the punch. The die was now cyanided, hardened, and ready for use.

The method of using is obvious. The strip of tin $\frac{5}{32}$ in. wide is slipped into the slot and fed along until the end is flush with the left-hand side of *B;* the punch *C* is inserted into the aperture *D* and, being guided by the part *E*, must be in alignment with the cutting part *G*. A light blow with the hand hammer on the punch causes it to pierce the tin and it can then be pushed through with the fingers. The strip is fed on and the operation repeated.

The time spent in finding the stock, making the die, slitting the tin and piercing and finishing 20 blanks was less than four hours. I have not been able to figure any shorter way of doing the job. This die cannot be ground, but it is not expected that over 200 blanks will be required.

A die made on the same principle for piercing and blanking washers from spring steel 0.012 in. thick is shown in Fig. 2. The washers must be free from burrs, so the guide and die, were made separate to allow grinding the die face. The guide *H* was made of cold-drawn machine steel and fastened to the tool-steel die *I* with the dowels *J*. The piercing and blanking holes were drilled and reamed through both pieces as one unit. The pieces were then separated, the stock slot *K* cut in *H*, and the die hardened and ground. The punches *L* and *M* were made of drill rod and hardened. This die was made in less than two hours.

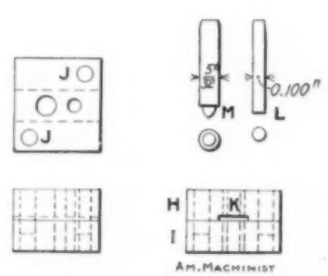


FIG. 2. PIERCING AND BLANKING DIE

During 1909 there were employed in the manufacture of agricultural implements 50,550 wage earners, according to a bulletin just issued by the Census Bureau. This showed an increase of 8.5 per cent. over the number employed during 1899.

Building Ice Machinery in the West

By F. A. Stanley

A method of boring cylinders of compressors in a Nebraska shop by mounting the main frame on a locating fixture on a horizontal machine and using guide bushings for the boring bar.

Machining crank shafts and boring and tapping headers. A home-made pipe bender and a tube expander.

The haltones illustrate some of the tools and methods in use at the shops of the Baker Ice Machinery Co., Omaha, Neb.

An ammonia compressor frame of the vertical type is shown in Fig. 1, in position for the boring of the cylinders, which are integral with the frame casting. This casting is first faced on the ends by swinging it in a big lathe, then it is placed upright on an Espen-Lucas borer and the openings are bored through the side walls of the crank case to receive the large flanged bearings for the crankshaft. One of these machined bearing seats is then usesd as a locating surface for the frame when it is placed on its side, as in Fig. 1, for the operation of boring the cylinders.

Locating Fixture and Boring-bar Support

The fixture over which the casting is located is similar to the one shown at *A*, which is used for a larger size of compressor frame. The fixture is formed with a square base, on the upper face of which a circular ring is finished to fit the opening bored in the side of the work. An upright cast on the base is bored out to receive two bushings which form an outboard support for the boring bar, and locate it correctly for the desired center distances between cylinders.

The boring-mill head is adjusted to the right height by gage, and the outer end of the bar, being guided in the manner described, it is a simple matter to bore the two cylinders to the correct center distance. A boring head with two cutters is used on the bar.

Crankshaft Operations

Two crankshaft operations are illustrated by Figs. 2 and 3. In Fig. 2 the shaft is represented set up for the turning of the pins, the stock between the webs having been cut out by drilling and sawing. A special form of tool post is fitted to the crosss-slide with an extension support for the tool, which is narrow enough to pass between the webs and support the tool directly under its cutting point.

The view in Fig. 3 shows a shaft-finishing operation accomplished with a hardened roll, which is used on both the pins and the journals.

The roll is about 4½ in. in diameter by ⅝ in. wide. It runs on a hardened plain stud with the head let into the roll face by counterboring. The finish-turning cut over the shaft removes about $^1/_{64}$ in. of metal on a side and about 0.003 in. is left for the rolling process, which leaves a very smooth surface.

Header Jigs

A method of holding headers for ammonia coolers while the joints at the ends are machined to permit one header to be coupled to another, is shown in Fig. 4. A female joint is formed at one end and a male joint at the other. The tools in the spindle in this view are for the female joint. They bore the hole through the casting, face the end flat and cut an annular groove to receive the corresponding male joint on the next header.

The same jig is later removed from the angle plate and placed upon its four feet while the holes for the pipes are machined. The header is shown from both sides, and it will be seen that it has in the back two small holes eccentric to the large openings in the face. These small openings are machined to receive 1-in. pipe, while the larger ones are for pipe, say 4 in. in diameter.

The jig is placed upon its back, or rather, upon its four feet, and the two large holes in the header are machined by means of the boring bar, taper reamer and tap, shown to the right of the driller table. An eccentric bushing is then put into one of the holes and the smaller hole for the 1-in. pipe is easily drilled through this in the correct position in the other face of the header. The bushing is then transferred to the other pipe hole, and the second eccentric hole put through the casting.

Larger Work

The parts seen on the table of the machine in Fig. 5, are flooded brine-cooler headers with holes machined in the two walls for 5-in. and 3-in. pipe, respectively. In this case the two pipe openings are concentric and are bored out by two sets of cutters carried in a single bar, which is guided at its lower end in bushings in the body of the jig.

The smaller jig, at the left in this illustration, is for holding a brine-cooler return bend, a swinging strap being provided for clamping and releasing the piece quickly.

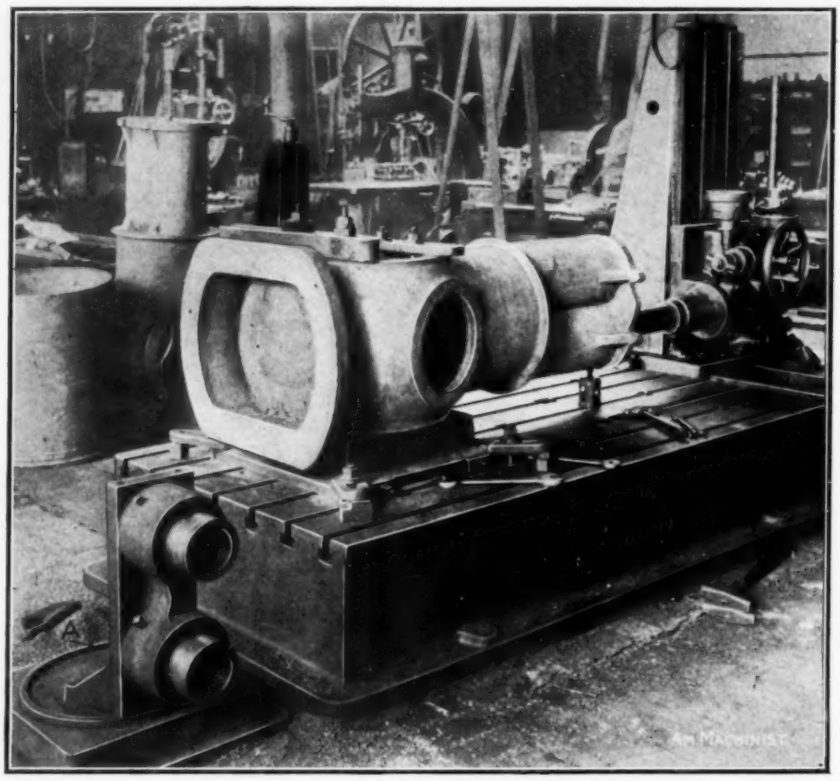


Fig. 1. Boring Compressor Cylinder

A Pipe-bending Machine

A home-made pipe-bending machine is illustrated in Fig. 6. It is driven by

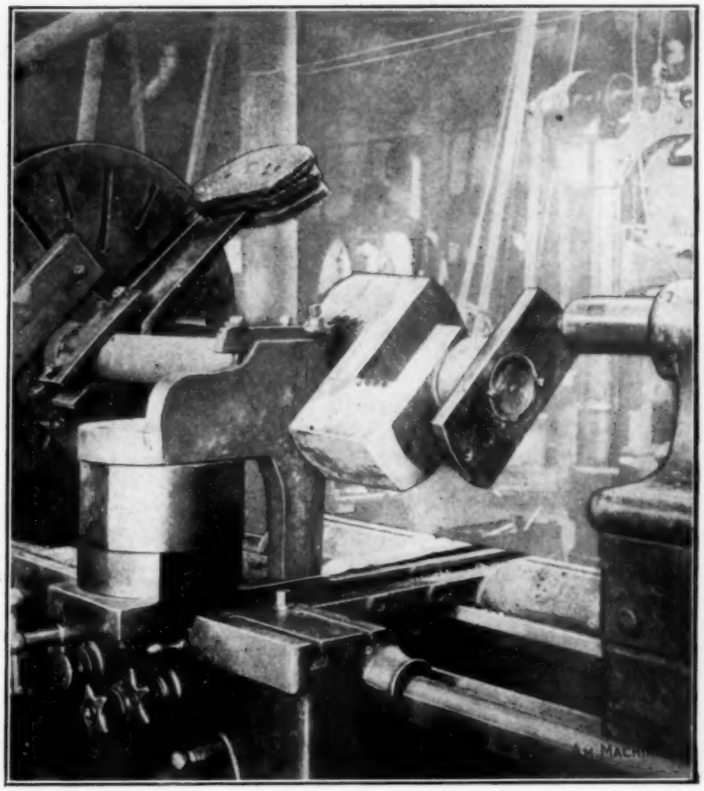


FIG. 2. TURNING CRANK PINS

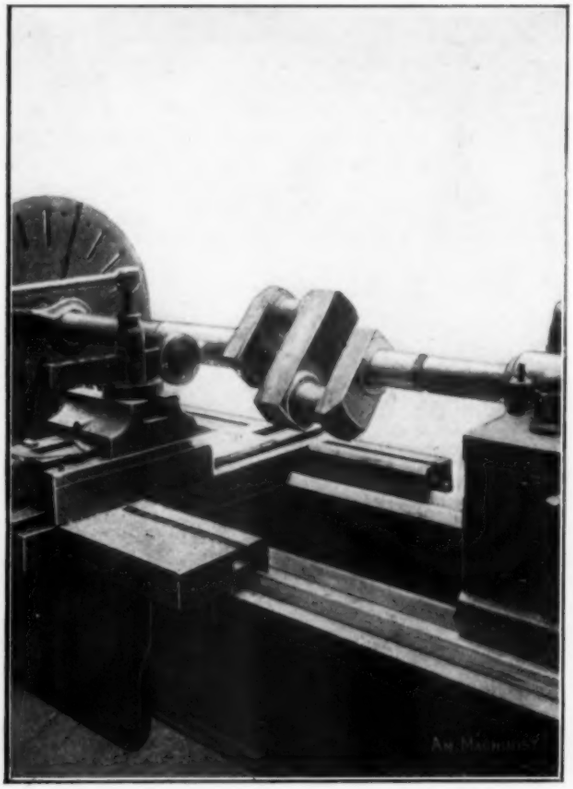


FIG. 3. FINISHING CRANKSHAFT BY ROLLING

wormwheel and worm and by spur gearing from the main shaft, near the floor. The shaft is driven by open and crossed belts or reversing pulleys, and a clutch in the drive is so controlled by the bending mechanism that after the machine is started on a bend it forms the pipe to the required curvature, then automatically reverses the drive, which carries the bending apparatus back to its starting point.

The machine is used for bending 1-in., 1¼- and 2-in. pipe. It handles pipe cold for bends above 8-in. centers. Below that the pipe is bent hot. One of the bending forms with its rolls and jaws is seen in working position on the table, and another outfit for a different size of bend is shown on the end of the table.

The pipe is gripped by pulling the vertical lever. This acts upon a spur pinion, which works between a pair of racks to open and close the jaws. The small guide rolls are adjusted to the work by the handwheel and screw. The machine is started by pulling the handle near the middle of the frame, and when the bending mechanism approaches the end of its predetermined rotary movement, it causes the clutch-shifting device to come into play, and at the desired point forward motion ceases and the mechanism swings back to its starting point for the next bending operation.

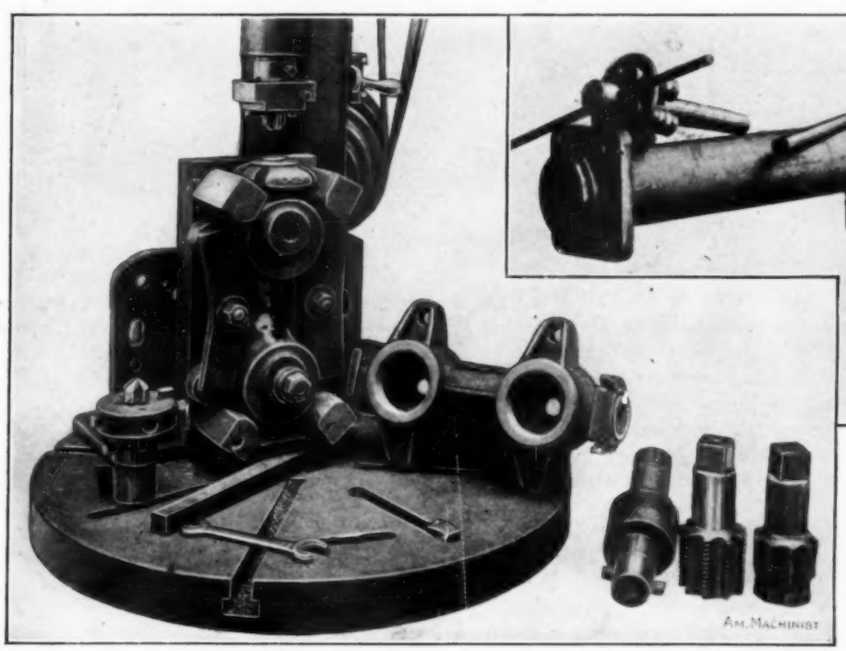


FIG. 4. JIG FOR COOLER HEADERS

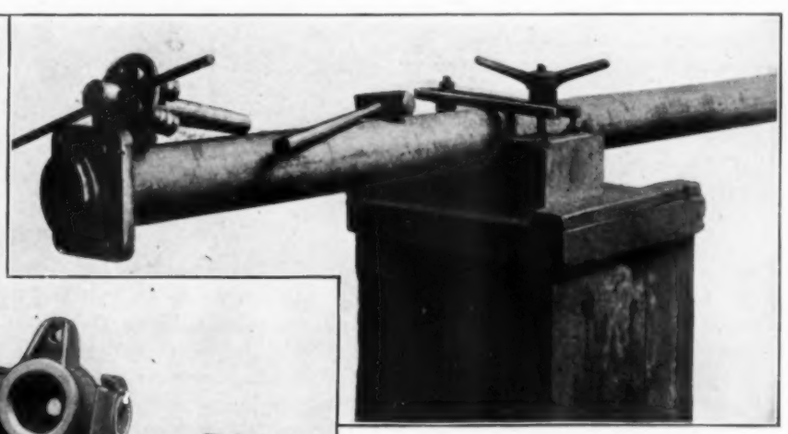


FIG. 7. A TUBE EXPANDER

AN EXPANDING TOOL

The device shown resting upon the tube in Fig. 7 is for expanding the tube into a recess in the square flange on the end.

The tube is used in a flooded brine cooler. The square flange is recessed internally to form a channel ½ in. wide by $\frac{5}{32}$ in. deep, and the metal in the 5-in. tube is swelled out to fit tight in this recess by means of the expanding tool, which consists of five rolls carried freely in a circular plate, through the center of which passes a taper plug, against which the rolls rest when the appliance is placed in the tube.

The hardened rolls have shoulders of the right width and depth to press the metal into the recess, and the whole affair is revolved in the tube by means of the long rod through the end of the taper spindle. The latter is driven in by a hammer to expand the rolls into the work, and a light blow is given at every turn or two of the device.

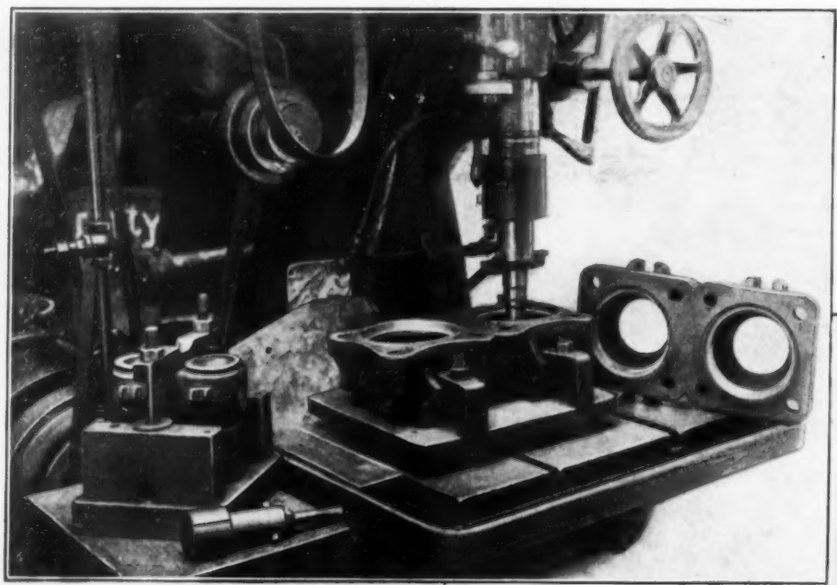


FIG. 5. JIGS FOR COOLER HEADERS AND RETURN BENDS

Thread Gages for Securing Uniformity in Machine Work

There is considerable difficulty in many quarters in securing a satisfactory fit between bolts or studs and tapped holes. The Heald Machine Co. is very particular regarding these fits and has adopted a plan which seems to be working out very well and which adds comparatively little to the cost of inspection.

This company endeavors to use the same make of tap and die, selecting the one which seems to give the best results in its work, and, by adhering to this, secures a very uniform product; for even though errors exist in the taps and dies, these errors are, presumably, uniform throughout the product.

In order to know how the bolts and studs are going to fit, it is the practice to take a piece of the same metal as the tapped hole and drill and tap this to the same diameter and depth as the hole in which the bolt or stud is to be used. As taps cut differently in cast iron, steel and other materials, it secures in this way a gage which will approximately be the same as the hole which is tapped in the body of the machine or any other part.

As this tapped hole is a counterpart of the hole into which the bolt or stud will fit, it is able to know before the work of assembling begins, that the threaded parts will go together without difficulty, even though they contain considerable error, or variation from a correct lead or diameter.

While this error does not determine the amount of error either in diameter, lead or angle of thread, it produces a very comfortable feeling in the assembling department, as machines can be put together without resource to doctoring the bolt by running the die over the thread, or relieving the hole with a special tap.

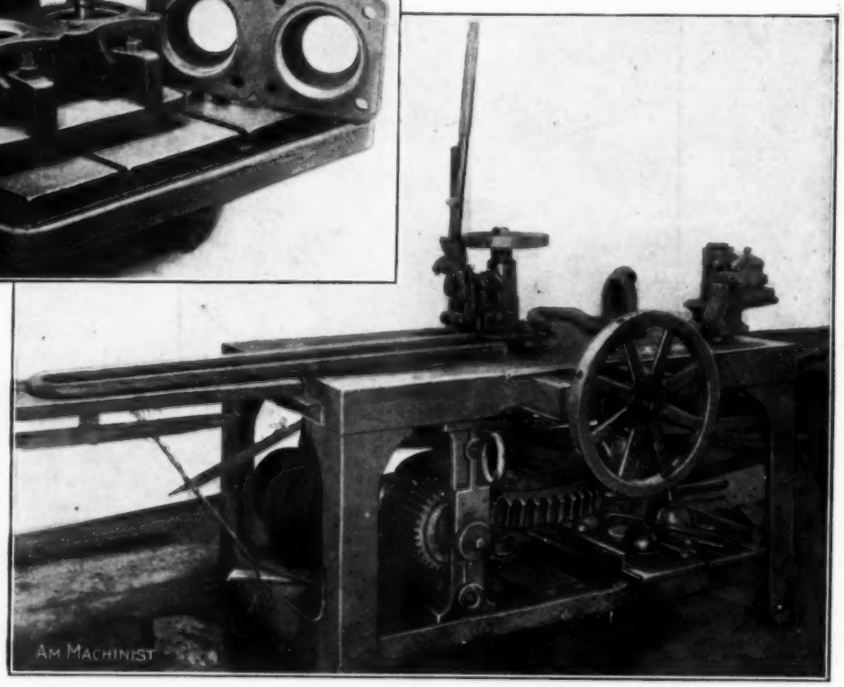


FIG. 6. PIPE-BENDING MACHINE

Annealing Cast Iron

BY HARRY A. HARTRANFT

Having had quite a little unsuccessful experience in annealing cast iron, I finally hit upon a method which seems to solve the trouble.

I had 34 small gray-iron castings to machine all over. These castings, on account of their delicate nature, came from the foundry as hard as flint. The walls of the castings were $\frac{3}{16}$ in. thick, and had to be finished on the miller, which makes it easy to understand that the iron in its softest state was not any too good for an operation of this kind.

At first, the usual method of heating the castings and then putting them in lime for slow cooling was tried, with no success at all. It then occurred to me that the slowest possible method of cooling would probably have the desired effect. Accordingly I divided the castings into two lots of 17 each, placing one lot at a time in a gas furnace having a pyrometer attached. The furnace was then heated until the pyrometer registered about 1800 deg., and by manipulating the air and gas, it was kept at this heat for two hours.

The furnace was started at 3:30 and shut off at 5:30, the castings remaining in the furnace over night and allowed to cool off with it. Herein lies the secret of the annealing process. In the morning when the castings were removed, every edge and corner could be filed. Moreover, they were positively soft all over, and were then machined without the slightest difficulty.

Letters from Practical Men

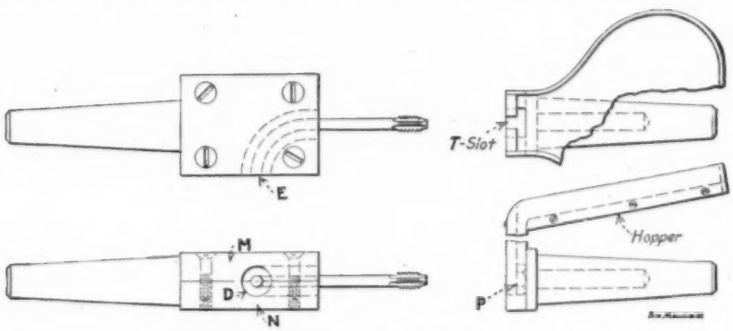
A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Tapping 5000 Nuts Per Hour

The illustration shows a very convenient little fixture for tapping large quantities of small nuts, at the rate of about 500 per hour.

The fixture shown is designed for use in connection with an ordinary speed lathe, although it can also be adapted to a horizontal taping machine.

The nut blanks from the punch press are thrown into the hopper shown, which is agitated back and forth by the feed handle attached to the tailstock, the sliding center of which carries this hopper. The agitation causes the nuts to arrange themselves flat and to slide down into the T-slot shown, and then to fall into the position *P* ready to be pushed forward by the tailstock handle and fed to the tap. A full line of blanks will be in the T-slot, so that as the tap takes one nut away another is instantly agitated into feeding position at *P*.



FIXTURE FOR TAPPING 5000 NUTS PER HOUR

The tap-holder may briefly be described as made of two pieces of machine steel, case-hardened and four screws as shown. *D* is the diameter of the curved hole through pieces *M* and *N*; it is just large enough to clear the long diameter of the nuts. The nuts are then fed on the tap until enough of them enter the curved hole to cause the curved tap to "float" in the center of this hole. Next, nuts are fed onto the tap until it is full, when the finished nuts escape at *E*. A cover must be placed over the tap-holder to throw all the nuts down in one place.

This is undoubtedly the fastest known method for tapping small nuts, as the lathe never has to be stopped while tapping is being done, and the tap will take the blanks as fast as the operator can agitate the feed handle, when all the conditions have been "worked up" right. The main thing to guard against is irregular nut blanks coming from the punch press. Those with burrs or fins on them clog the entrance of the T-slot. The lubricant is soap and water with a little soda added to prevent rust. This lubricant should be supplied by continued drops on the tap.

The old method of tapping small nuts with a long-shanked tap, feeding on nuts until the shank is full to the chuck jaws, then stopping the machine and removing the tap and nuts, cannot be worked for over 900 to 1000 nuts per hour.

C. W. HINMAN,
Chief Tool Designer,
Automatic Electric Co.
Chicago, Ill.

Broaching Spiral Keyways

In an article discussing attachments for milling spiral keyways, the attachments shown were complicated and delicate, and the use of a small end mill was necessary. The time stated for milling the two spiral internal keyways was 14 minutes for each piece. I give herewith an idea of the production that can be obtained on a modern broaching machine operated by unskilled labor.

Two ½-in. spiral keyways in a 1¼-in. hole are shown in Fig. 1. These pieces are about 3 in. long, and a production of about 25 to 35 per hour is obtained. The gears are very accurately broached in regard to the width of the keyway and lead of the spiral. This is a very high production for such a piece. There are, no doubt, many places where similar pieces could, but have not been, used because the piece was considered too expensive. With the modern broaching machine and with properly designed broaches, the cost of machining a piece of this nature is very little indeed.

Two spiral keyways, one left- and one right-hand, are seen in Fig. 2. The piece shown can usually be done in one operation depending upon the length of the work and material to be cut. It is accomplished by the use of a special double spiral broach which cuts the two keyways

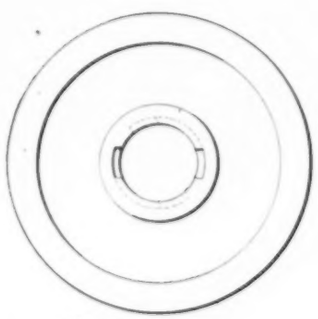


Fig. 1 Spiral Keyways

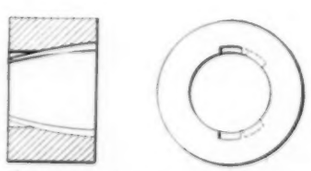


Fig. 2 Left and Right-Hand Spiral Keyways

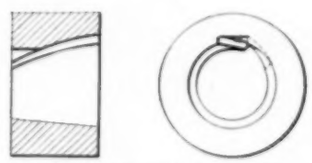


Fig. 3 Spiral Keyway in Tapered Hole

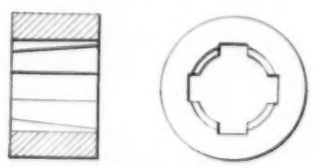


Fig. 4 Four Straight Keyways Cut in Tapered Hole

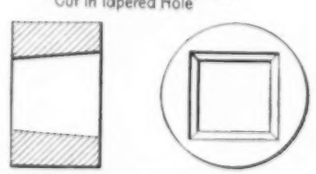


Fig. 5 Tapered Square Hole

AM. MACHINIST

BROACHING SPIRAL KEYWAYS

at one stroke of the machine. This assures proper indexing of the two keyways with relation to each other.

A spiral keyway in a tapered hole is shown in Fig. 3. This can also be done in one operation, and while it is very rare that a keyway of this shape would be called for, this only gives an illustration of another peculiar piece that can be done with properly designed broaches. This piece can be broached very accurately as regards lead of spiral and width of keyway, but there is a slight defect as to the depth owing to the taper of the hole. This being so slight, in most cases it is negligible.

Four straight keyways cut in a tapered hole are represented in Fig. 4. These can be all cut in one operation, giving a production of about 30 to 40 per hour. Almost any number of straight keyways can be cut in a tapered hole in one operation with properly designed broaches. These pieces can be broached very accurately and the production is very high. This type of keyway is a common form used in the automobile and machine construction of today, but in most cases two keyways are used at 180 deg. apart or two keyways at 90 deg. apart.

A tapered square hole with all surfaces clean is shown in Fig. 5. This piece has heretofore been broached leaving portions of the bored tapered hole in the center of the flats. While this really is not objectionable in most cases, all surfaces can be broached clean where it is so desired, and the production obtained would be about the same as when portions of the round hole remain in the center of the flats.

Referring again to Fig. 1, this is getting to be a common form of piece used for advancing and retiring the spark on gas engines, and has many advantages over the old way of accomplishing this movement.

FRANK J. LAPOINTE.

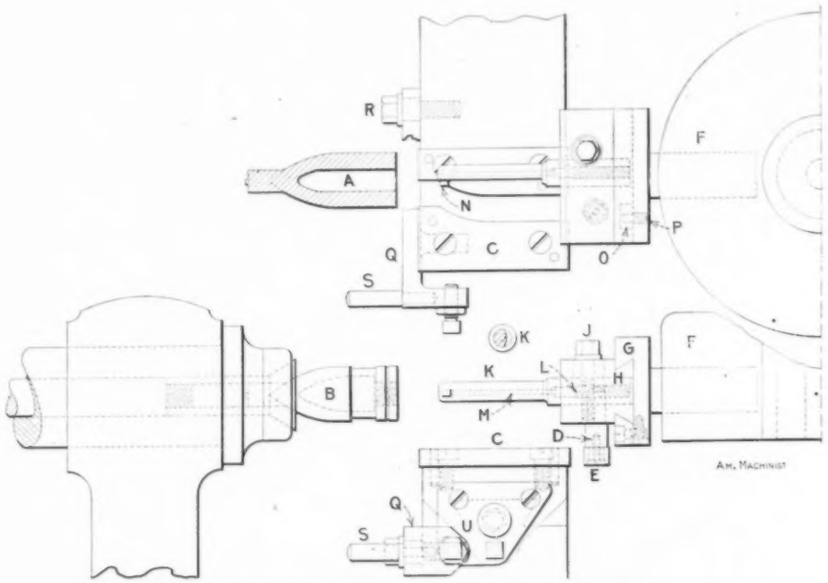
Marlboro, Mass.

Method of Boring Irregular Holes in the Turret Lathe

While quite a few boring bars for use in the turret lathe have been described in the AMERICAN MACHINIST, I have not seen anything quite like that illustrated. It may not be new to some of your readers but making use of a form for reproducing the same shape on the work was original with me.

The work *A* to be bored is first blanked out inside and cut as shown. The lug at the left is cut off as shown by the dotted lines after boring out the inside and finishing the outside as shown at *B*. The form in which the stud *D* and the roll *E* move to determine the shape of the bore is represented in *C*, which is screwed and doweled onto a block to raise it up to the required height. The turret head is shown at *F*. It carries the body of the tool *G* in which moves the slide *H* carrying the boring bar *K* with the hardened screw *L* and the spring-tempered rod *M* for locking the high-speed steel cutter *N*.

At *G* is shown an end view of the boring bar showing how it is milled away on one side to give clearance for the cut and at the same time leave it as stiff as possible. It is made of spring-tempered tool steel. The binding screw used to secure the boring bar in the slide is shown at *J*. A recess *O* is milled in the slide *H* to control the end movement, and the screw *P* keeps it from sliding out of place.



BORING IRREGULAR HOLES IN A TURRET LATHE

In operation two boring bars and holders are used, one for roughing and one for finishing, with cutters ground somewhat as shown by the dotted lines, or modified to best cut down and rough out, and to finish, both being done at one chucking. The stock is about 50-point carbon steel, very tough and sometimes very hard.

The roll is entered in the formed groove and the cutting tool entered the right distance into the stock *A*, when the cross slide carrying the form is fed toward the operator, bringing the cutter the required depth into the work, which is indicated by the auxiliary stop *Q*, fastened by the shoulder screw *R* to base of cross slide, and being pulled into place by the small handle *S*, so as to form a stop against the plate *U*, which is screwed fast to the end of the moving cross slide. The cutter is then fed along the work the required distance.

The screw *R* is adjusted so that the lever remains in position when lifted up, and when not used is pushed down out of the way of the regular stop, which is needed for the front and back tools for making the outside cuts, as shown. Thus by the use of the extra stop, the piece is bored out, tapped, and the large end finished, including the two cuts with the front and back tools at the same chucking. An ample stream of soda-water was used to wash out the chips, as it was found that oil would not get the chips out of the hole readily enough.

I see no reason why this arrangement should not be used on a variety of work of this class as it can readily be applied to almost any hand turret lathe.

EDMUND S. WILLIAMS.

Bridgeport, Conn.

Tools to Cut Thread Gages

Some very accurate master thread gages were to be cut and as no tools sufficiently accurate were found among the regular equipment, it was decided to make the tools and gages required. Experiments were made to find a lathe having a sufficiently accurate screw and the machine chosen was thoroughly overhauled.

The ways for the carriage were put into good condition, the centers were ground to accurate 60-deg. angles and the tailstock center was aligned with the headstock. The blanks, having previously been roughed out on another lathe, were annealed and finish-turned on their outside diameter, with 0.005 in. left to grind, after which they were ready to be finish-threaded.

In Fig. 1 is shown the threading tool and tool-holder used to perform the finish-threading operation. The tool, made of Hobson's Choice steel, was ground on the surface grinder after milling and hardening to 0.187x0.375 in., this being the size of the slot in the tool-holder; it was held in the holder by six fillister-head screws, bringing the side plate into contact with the side of the tool and forcing the tool against the left side of the slot. In the bottom of the holder a groove was milled and in the shank end

of the holder a ground bar, which is a working fit in the slot in the front bottom end, was soldered. The purpose of this construction is to overcome any tendency of the front end of the spring threading tool-holder toward side deflection when under cutting pressure, and in its use no trouble was experienced in this respect.

The angles on the front end of the threading tool were ground on the surface grinder, using the block shown in Fig. 2. This block is made of machine steel, ground all over, the angles being ground by the use of the sine bar, illustrated and described in these columns by H. P. Camp, in Vol. 34, page 1073. This gives a front clearance angle of 15 deg. and a side clearance angle of 4 deg. 48 min. Subsequent grinding for sharpening is performed only on the top face.

The lathe used for the finish threading was one having a stationary height of cross slide and as provision had to be made for the elevation of the threading tool to the center line of the lathe centers in order to obtain the correct angle on the threaded gages, the elevating tool-post collar shown in Fig. 3, was employed. This was placed under the threading tool-holder and the top face of the threading tool was elevated until brought into contact with the gage for testing the thread-tool height, shown in Fig. 4. This gage, after being ground to 0.750 in. diameter and having the central part ground out to the center or until it measured 0.375 in. from center to outside, was placed between the centers of the lathe with the flat portion downward and the thread tool raised until it came into contact with the ground surface.

The height of the threading tool being determined, the tool was adjusted to the proper angle in relation to the work by the use of the gage shown in Fig. 5. This gage was made in the bench lathe and after being turned and hardened, was ground by the wheel being set to work at an angle of 30 deg., the work being reversed, end for end, so as to get the same angle on each side of the center.

The angle was tested by the use of two wires laid in the groove and measurements made over the outside of the wires by ordinary micrometer calipers. By using wires of three different diameters, contact was made with the angle of the thread at three different places in its depth and correction was made in the grinding until the results were up to the standard set for the approval of the gage.

CHAS. F. SCRIBNER.

Hartford, Conn.

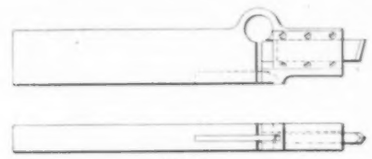


Fig. 1
Threading Tool and Holder

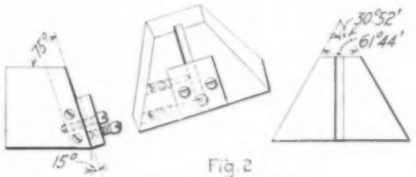


Fig. 2
Block for Grinding

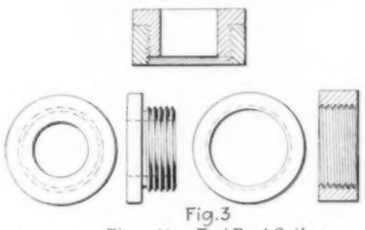


Fig. 3
Elevating Tool Post Collar

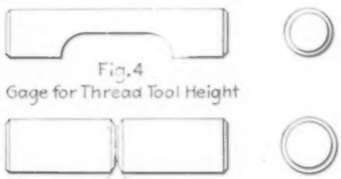


Fig. 4
Gage for Thread Tool Height

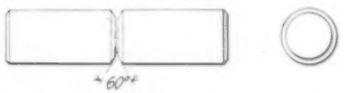


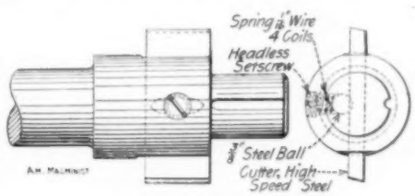
Fig. 5
Gage for Thread Tool Angle

SPECIALLY DESIGNED TOOLS FOR ACCURATELY CUTTING MASTER THREAD GAGES

A Floating Reamer

This reamer was made with solid shank and stationary holder and was used in a Potter & Johnston automatic, though there is no reason why the same idea cannot be used in a lathe, borer, or any machine where a reamer is used.

We had been having trouble with various styles of reamers, solid, shell and expansion, in not giving us perfectly smooth round holes for a thrust-bearing cage holder on the axles of automobiles. These cages were made of steel castings and as they sometimes came porous on the surface, the trouble resulted in machining.



A FLOATING REAMER

I designed and made the tool shown. This reamer gave us excellent results and it is not a costly tool to make; the shank, of course, as to length and diameter, is designed to suit the machine used. The sizes given are of the tool I made.

The bar is turned to the desired size, the slot cut for the cutter and the hole drilled and tapped to suit the headless setscrew, spring and ball. A $\frac{1}{16}$-in. deep groove is cut in the cutter to suit the ball. The cutter must be a good sliding fit on the bar sidewise and also endwise.

Place the cutter in the bar, insert the ball and spring, and screw in the headless setscrew to its seat. The bar is piloted in the work, oil grooves are cut in the bar in the usual way.

In action when using the bar and reamer, the reamer cutter sliding in the slot, which is made possible with the ball and spring, follows the hole, making it perfectly smooth and round, the chatter which always is evident with a solid reamer being absorbed by the spring.

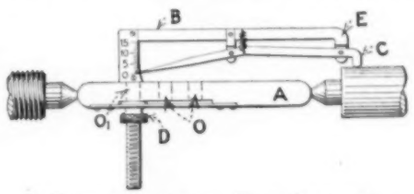
There is a further advantage over some of the floating holders in that the drive is positive and with these floating holders there is an amount of backlash caused by their construction. I made some of these reamers with formed surface cutters and obtained the same excellent results as with the straight surface shown.

Providence, R. I. ROBERT MAWSON.

Another Test Indicator

The indicator shown was designed for the purpose of testing the alignment of lathe centers. In a shop where the tailstock is moved frequently, it is a quick and accurate instrument for realigning the centers.

The body *A* is a bar of machine steel with three holes milled as at *O*, *O*, *O'*, through which the vertical section of the arm *B* slides as shown at *O'*. These holes permit longitudinal adjustment of the contact point *C* which is necessary, as lathe centers vary in length according to make, size, and wear.



A QUICK, ACCURATE TEST INDICATOR

Located centrally and at right angles to these holes are three tapped holes for thumb setscrews that bear against a flat surface milled from the graduated plate to the end, on the back of the vertical section of the arm *B*, for the purpose of holding the contact point *C* central with the lathe centers.

The nut *D*, acting on the threaded section of the arm *B*, is used to adjust the contact point *C* vertically to conform to the several diameters of tailstock spindles. The remainder is self-explanatory, except that all necessary parts are hardened and ground; this is particularly true of the bar *A*.

To use the indicator place it on the lathe centers with the contact point rest-

ing on the tailstock spindle, revolve it, and any error of alignment to 0.001 in. will be shown immediately on the graduated plate. Testing the alignment of lathe centers, however, is not the limit of this indicator. It is accurate in testing the vertical and horizontal alignment of tailstock spindles, in setting the tailstock over for cutting tapers, and by reversing its position on the centers may be used to test the truth of work on the faceplate. By slightly modifying the arm *B* at *E* any dial indicator can be used instead of the contact point *C*.

L. H. HAIGHT.

New Bedford, Mass.

A Wire Loop Forming Die

The cuts illustrate a wire-loop-forming die that helped me out of a very tight place some years ago.

The wire was about 0.07 in. in diameter, and the finished loop about the size illustrated. The body of the punch *B*, Fig. 1, was made of wrought iron; the forming piece *I* of hardened tool steel; the forming punch *A* is a tool-steel forging, machined all over and hardened where it comes in contact with the work; the latch *C* is also made of tool steel, hardened and drawn; the ring *K* gives a good bearing to the spring *L;* the threaded plug *D* serves to keep the spring confined.

The body of the die *G* is a casting machined on top and bottom; the tool steel pieces *EE*' are hardened and finished by grinding, being left a trifle wider than 12 times the diameter of the cone. Plates *FF*' act as guides, keeping the wire from rolling off the die; *N* is tool steel, hardened.

In operation, the press hand places on the die a dozen or more wires, which have previously been straightened and cut to length, and as there is room only for 12 between the guide plates, a slight rub with the fingers rolls off the surplus. The press clutch being released, the wire is first formed as shown in Fig. 2. The relation of dog and trip is such that before the punch *A* bottoms, *C* engages with *H* and releases *A;* the press slide continuing its descent, compresses spring *L*, and *I* forms the ends of the wires as shown in Fig. 3.

The press should be so adjusted that *B* and *A* continue the descent together for a slight distance, thus giving the work a final sizing. The clips remain on the punch, and are readily removed, there being a slight springing apart of the loops after leaving the die.

Delphos, Ohio. A. J. BRICKNER.

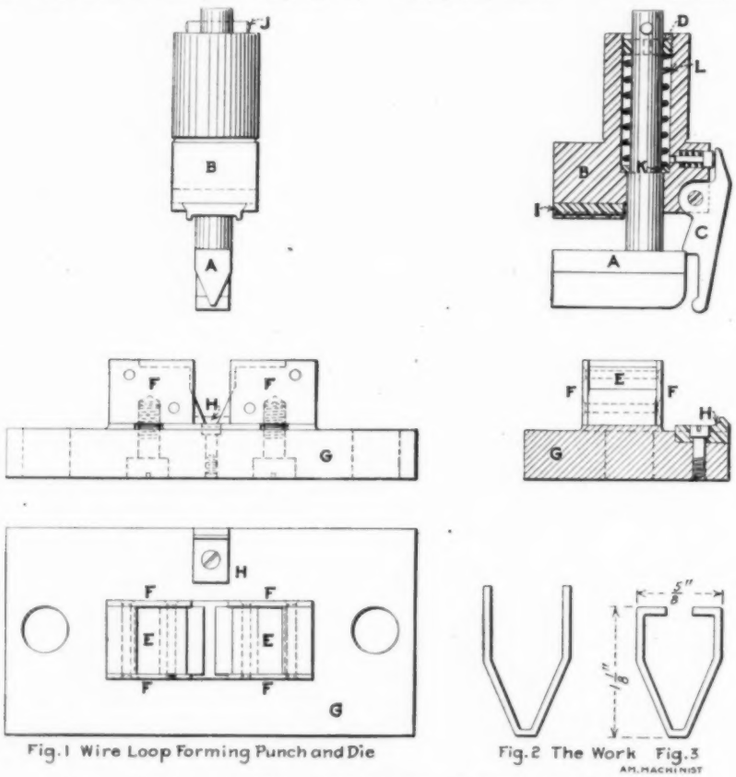


Fig. 1 Wire Loop Forming Punch and Die

Fig. 2 The Work Fig. 3

AM. MACHINIST

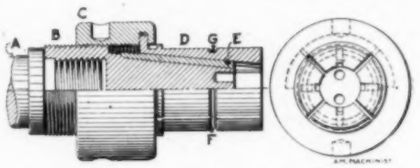
DETAILS OF WIRE LOOP-FORMING PUNCH AND DIE

An Expansion Mandrel

The cut shows an expansion mandrel for a lathe spindle. *A* is the lathe spindle, *B* is the cone with the rear portion threaded on the outside for adjusting the nut *C;* threaded on the inside for the lathe spindle. *D* is the expansion sleeve cut in four or more segments with keyseats and the groove *F*. The key for grinding and keeping the segments from turning is shown at *E*.

A steel spring or elastic band for holding the segments, or jaws, together when the work is removed is seen at *G*. Segments to take in larger diameters can be made to fit the same cam, or additional pieces screwed on the segments will also answer the purpose.

The advantage of this mandrel is, that it always remains in the lathe ready for



EXPANSION MANDREL FOR LATHE SPINDLE

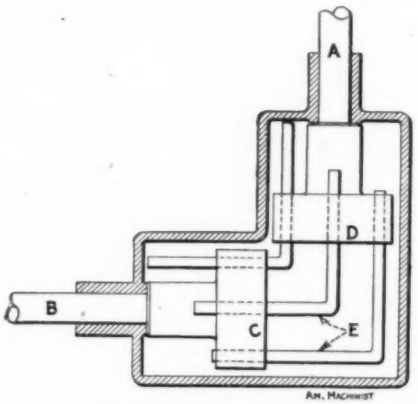
action, where a mandrel that is used between centers must be taken out and hammered in order to restrain and release the work. As these mandrels can be made to expand ½ in. or more, and to any diameters and lengths, we are satisfied that they are the most suitable tools for manufacturing purposes.

Bloomfield, N. J. J. ULYSSES.

An Odd Angle Drive

I have seen the apparatus described below used as a substitute for a pair of miter gears.

In the cut the shafts *A* and *B* each have a flange keyed on ends and any suitable number of reamed holes in each. Three rods *E* are bent at right angles and one end of each rod is inserted in one of the holes in the flange *C*, while the other end is put in the corresponding hole in the flange *D*.



AN ODD ANGLE DRIVE

As one shaft revolves the rods transmit motion to the other and slide in and out in their respective holes. The whole is inclosed in a tight case and works in oil.

I know of one of these drives that ran for five or six years at about 200 r.p.m. transmitting about 5 horsepower and never giving any trouble; in fact I think the casing was never opened after it was put in service.

Philadelphia, Penn. W. ALTON.

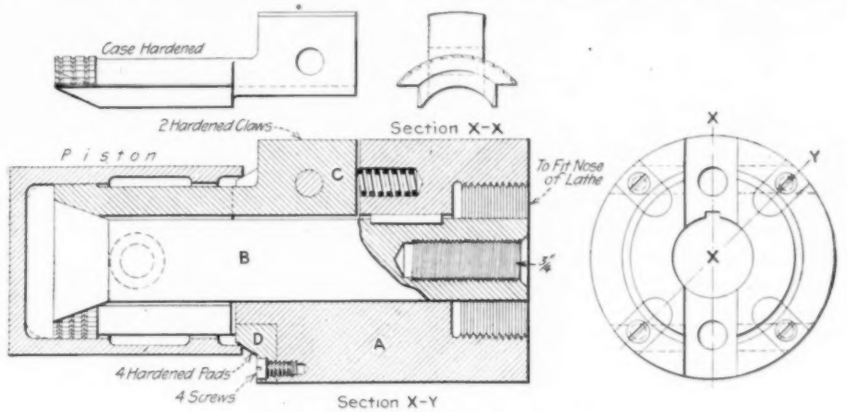
[These angle drives usually have two flanges on each shaft with bearings for the bent drivers.—ED.]

Discussion of Previous Question

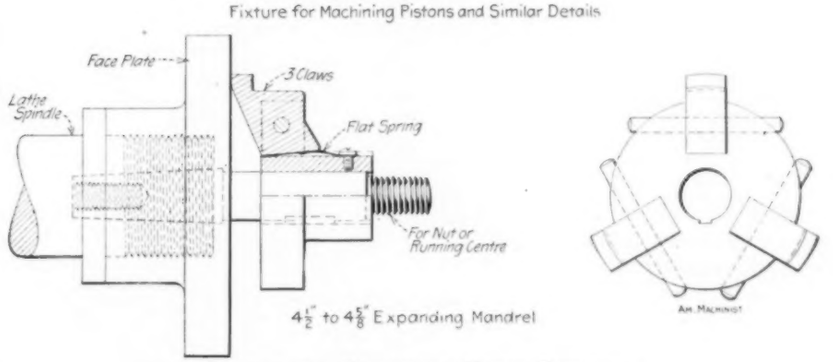
Referring to letters and articles previously published

Fixture for Machining Pistons

I have found the following fixture very satisfactory for machining motor pistons. Of course, it is necessary to set the pistons true to the core to insure equal thickness after grooving for the rings, but not many pistons are cored true to the outside diameter. The fixture illustrated is self centering and is operated by a handwheel at the tail end of the lathe spindle.



Fixture for Machining Pistons and Similar Details



FIXTURE FOR MACHINING MOTOR PISTONS

The chuck screwed on the nose of the lathe spindle is represented by *A*. *B* is the spindle with a cone end to operate two claws. It is connected through the spindle of the lathe by means of a stud with a handwheel screwed on the end for adjustment. *C* are the claws. At *D* are the hardened pads fixed in the chuck to locate the open end of the piston.

First Operation—Slip the rough casting over the claws and tighten the handwheel, this will expand the claws inside the piston and draw the piston onto the hardened pads *D* that locate the open end of the piston.

Second Operation—Fix in a universal chuck with soft jaws and bore and face the open end of the piston. Then reverse the piston and face the blank end to finish length.

Third Operation—Fix the piston on the spigot chuck that fits the open piston and finish turn, etc.

The other fixture is an expansion mandrel with three claws useful for turning and facing piston rings, flanges or the like. The more pressure put on the claws, the more it grips the work to be done.

Coventry, England. A. WINDRIDGE.

Standardizing Drills

The plea of E. D. F. in Vol. 36, page 391, for standardizing straight-shank drills appeals to me very strongly.

In the plant where I am employed there have been in use for several years collets running in eighths of an inch for straight-shank drills, commencing at ½ in. and running upward. The sizes smaller than ½ in. are held by chucks.

All drills between ½ and ⅝ in. have their shanks turned to ½ in. before being put into service; those between ⅝ in. and ¾ in. are turned to ⅝ in. etc. This method makes it necessary to have but few collets and works very satisfactorily.

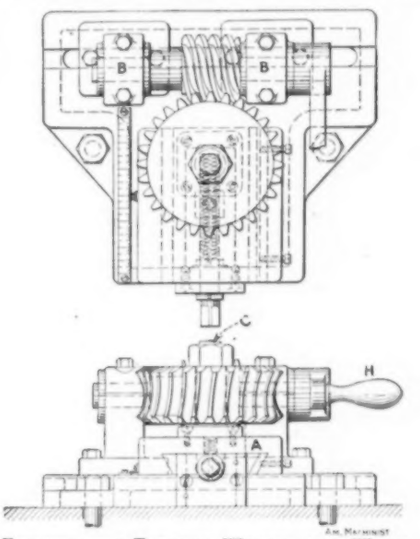
Possibly to meet the varying conditions of all shops most successfully it would be better to make the shanks vary by sixteenths instead of eighths, but for either it would save the user considerable expense if the manufacturers would put them out in the way suggested.

MARTIN H. BALL.

Watervliet, N. Y.

Fixture for Testing Worms and Wormwheels

Our worms and wormwheels for turbines did not run smoothly when assembled, and consequently caused us a lot of trouble. I designed the fixture shown



FIXTURE FOR TESTING WORMS AND WORM GEARS

to run and test these before assembling.

The carrier *A* is adjustable to take varying diameters of wheels. The adjusting screw has a collar graduated to read to thousandths and on the bed is a scale and pointer, so that a fine adjustment can be obtained. Bearings *BB* can also be adjusted along the bed to take varying lengths of worms between shoulders.

In operation the wormwheel is put on the spindle *C* and runs freely under the nut. Worms are put in the cap bearings *BB* and are operated by the handle *H*, which fits in a hole in the wormshank.

We had no further trouble after running worms in this fixture, as we were thereby enabled to get correct center distance for running.

Manchester, England. A. KEYE.

Separate Pattern Maker's and Shop Drawings

In the article, "Separate Pattern Maker's and Shop Drawings," appearing in Vol. 36, page 505, I notice that the Kempsmith Manufacturing Co. uses a sheet of tracing cloth twice the size of the drawing required, folding it, like the pages of a book. On one side, or page, are all the machine-shop dimensions required, and on the other page are the pattern maker's additional dimensions.

I prefer taking a sheet of tracing cloth the exact size of the drawing wanted and after tracing the views, ink in the machine-shop dimensions (as practically all the machine-shop dimensions are used by the pattern maker). The additional dimensions for the pattern maker are then *penciled* in.

Two prints are made from the tracing and one sent to the pattern shop and the other filed away in the vault as a pattern record. The penciled dimensions are then erased, leaving only the machine-shop dimensions. A print is then made and sent to the machine shop.

This method has proved very satisfactory and is much cheaper than the method of the Kempsmith company.

WALTER H. STICKLER.

Cleveland, Ohio.

The article on this subject in Vol. 36, page 505, describes an efficient method for supplying the pattern and machine shop, each with a drawing suitable for its individual requirements. A simpler and less expensive method is described as follows:

In the case of cast parts, the original paper drawing is made to suit the particular requirements of the pattern maker, and the dimensions only are inked in. A tracing is then made to suit the particular requirements of the machine shop, and after both drawing and tracing have been checked, the paper drawing is immediately available for the pattern shop.

Inasmuch as the pattern maker's drawing is usually required but once, and the paper drawing is immediately available upon the completion of the tracing, no time is lost in starting on the pattern.

In the above case, the paper drawing is made to serve a twofold purpose, contrary to the somewhat common practice of discarding it upon the completion of the tracing. Many shops, in fact, do not take proper care of their original drawings, and in many instances these are destroyed or left to the draftsman, to be disposed of.

I have seen original paper drawings in the hands of draftsmen formerly identified with large and well known concerns, and have been much impressed by the laxity on the part of the engineering department in such instances.

There is a further byproduct which may be obtained from the original paper drawing of the larger and more complex parts, in its later adaptation to new or modified designs. In many cases the older drawing represents more than half the detail of a new, or modified design.

In any case, it is good business to have all such original drawings accounted for by the draftsmen to their chief, and the personal attention which he should give to them should be a positive safeguard, and in many instances an economy.

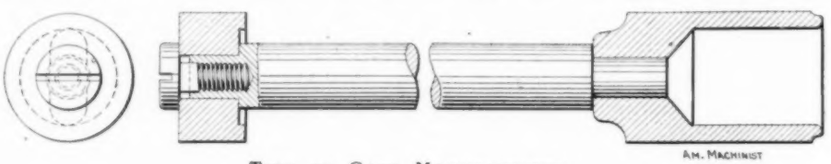
WILLIAM E. CHOATE.

Boston, Mass.

Manufacturing Plug Gages

It occurred to me after reading the editorial "Manufacturing Plug Gages at Low Cost," in Vol. 36, page 477, that perhaps readers might be interested in the method employed by the Detroit plant of the Chicago Pneumatic Tool Co. Most readers, I am sure, can appreciate the importance of making the barrels of pneumatic hammers of a uniform size to obtain interchangeability. In doing this a great many plug gages of various sizes are employed The cuts will, I think, be understood without difficulty. I have omitted sizes as they can be made to suit requirements.

We make this style of gage in sizes from ¾ to 2½ in. in diameter, and the handles from 3 to 20 in. in length. While the cut shows the standard length of plug used, namely ⅝ in., we have some 1 and 1¼ in. in length. Two sizes of handles are made on the automatic screw machine of cold-drawn steel. The grip is also made in two different sizes and of cold-drawn steel. It is unnecessary to make the gage proper longer than ⅝ in. as the wear will usually show on the point which, when worn, can no longer be used.



TYPE OF GAGE MANUFACTURED

The gages are taken off the handles and put among the discarded gages until they can be used for a small size; they are then annealed, refaced to remove the stamping and made into the next size smaller gage. The handle, of course, is practically indestructible. Only the best grade of tool steel is used for these gages. Some of the important ones are made and tempered from six to twelve months before grinding.

The milled recess in the gage fits over the flattened portion of the handle to prevent turning. The handle is a driving fit in the grip and a loose fit in the gage to avoid distortion, depending entirely on the clamping of the screw to hold the gage against the lock. This method is also employed in the making of thread gages.

L. E. SUMMERS.

Mgr. Chicago Pneumatic Tool Co.

Detroit, Mich.

Knurling Tools for the Screw Machine

At page 295, S. N. Bacon has an article on the above subject describing a number of knurling operations which are not generally seen in common practice.

Referring to his Fig. 4, I wish to inquire where the cutoff tool for this piece is placed. It appears from the drawing that the form tool is placed on the rear cross-slide and the knurl tool on the front slide. In this case I do not see how the piece is cut off, as bringing forward either cross-slide is going to cause either the form tool or the knurl to engage again with the work.

What Mr. Bacon calls a most interesting knurl is shown in his Fig. 6, on page 296. He tells us that the largest hole is knurled first with the end of the arm guided by the lowest step on the pusher *D*, the next hole is knurled with the arm guided by the middle step *D D*, and the smallest hole with the arm on the highest step *B B*. He fails to explain how the knurl is made to operate in the smallest hole when, because of the arm resting on the highest step, the arm carrying the knurl is pushed out further than when knurling the largest diameter.

With reference to Fig. 8 he says that what is almost an impossibility, knurling eccentric work from the turret, is successfully accomplished by the .device shown. He shows two eccentrically pivoted knurls which are to operate on an eccentrically revolving part. A glance at the lower knurl, and the part to be operated on, placed with their shortest radii in line, causes an interesting speculation as to what will happen when the increasing radii of the work and the knurl coming together, try to accommodate themselves between fixed centers. A further inspection of this sketch will show that the upper knurl becomes inactive from lack of pressure, when the work revolves toward the knurl, and the radius of the work decreases.

Another eccentric job is represented in his article on page 235, when, in Fig. 8, as may be seen, at the start of the revolution of the part, both knurls bear, but as the piece revolves eccentrically it bears first against one knurl, and then

against the other. This process must produce a curious finish where the cuts are made by one knurl, and the surface of the work is gaged up by the other one when it comes in contact.

In his Fig. 5, in the same issue, Mr. Bacon has failed to enlighten us on one of the most interesting points; that is, by what process of assembling was the shoulder screw on which the angular knurl revolves, put into the holder.

Harrisburg, Penn. J. H. HARRIS.

Machine and Tool Builders

I have read with especial interest, the article of D. M. Wright in Vol. 36, page 560, also your editorial in reference to the matter of incorrectly naming the Machine Tool Builders' Association.

Mr. Wright in his article, has no doubt given a very good substitute nomenclature for the National Tool Builders' Association and if, in addition to this, the builders of metal-working machinery would call their product machines instead of tools, it would certainly be more nearly correct. In fact it seems that our company, and manufacturers of similar tools for milling machines, lathes, shapers, etc., are tool builders or tool manufacturers, and the so called tool builders are correctly machinery builders or machinery manufacturers. This matter should be taken up by the National Machine Tool Builders' Association at the June convention at Atlantic City.

There is also one other thing which I believe could be brought up to advantage at the same time, that is, the size of the slot or hole in the tool post. I find for instance on an 18-in. swing lathe, that there will be as much as three or four different sizes. This I presume comes from the former use of forged tools, when the standards were not so uniform as at present. On account of the immense increase in the use of tool-holders in place of the old-fashioned solid bar, which we believe, except for special purposes, will eventually displace all forged tools, it would seem as though a general standard size of slot in the tool post could be adopted to advantage.

Tool-holders are now generally standardized, such as ½x1, ⅝x1¼, ¾x1½, 1x2, etc. Our suggestion would be that all lathes from 14- to 16-in. have one size of hole in the tool post, 18- to 20-in. another size, 21- to 24-in. another, and 25 to 28-in. another.

THOMAS FISH, President,
The Ready Tool Company.
Bridgeport, Conn.

Direct and Indirect Costs

The paper on this subject by J. Edtterson in Vol. 36, page 387, provides a very easy way of dealing with the vexed question of burden, namely by taking no notice of it, as far as the shops are concerned. This is a somewhat novel proposition, and however convenient it may be under the special conditions obtaining in a government plant, it is certainly in direct opposition to modern methods of handling burden. I will first cite some opinions on the point.

A CLEAR STATEMENT OF BURDEN

One of the clearest statements of the case is made by Gershom Smith, late comptroller of the Pennsylvania Steel Co. Writing in the *Engineering Magazine* recently he said:

> Wage costs, heretofore so largely relied on as a basis for estimate and distribution of indirect charges, are steadily waning in relative value in the industrial formula, and are constantly becoming more inseparably bound up with machine costs. It is not the operative, but the operative plus his machine that we must regard as the producing unit. Hence, as far as manufacturing costs are concerned, our fundamental measuring rule becomes increasingly inaccurate if we continue to divide it by the scale of men's wages or men's time. We need a new scheme of graduation, which will be commensurable throughout with the scale on which our costs of production are actually being built up. This new unit of division is found in the machine-hour.

Another aspect of the question is given by D. Newman Collins. Writing on the subject of Design of Industrial Buildings, he says:

> A comparative glance at an old and a modern shop will show the latter to be characterized by the absence of men and the substitution of ponderous machines. . . . . It requires $25,000 invested at 4 per cent. to maintain one man in service at $1000 per annum.

MACHINE COST OF OPERATION WANTED

Space forbids other citations, but those given will serve to show that there is another side to the question, overlooked by Mr. Edtterson. What every plant wants is not the true wage cost of operation, but the true machine cost of operation, of which labor is only a part. When it is considered that burden may vary from 90 to 150 per cent. and more, of direct labor, the importance of an accurate connection of burden with individual jobs, at the tool point, can be estimated.

The object of a plant is to manufacture, and in pursuit of this aim, various subsidiary activities are undertaken, all of which, in so far as they have any justification, are in the nature of services to direct production. Each machine is a "production center" making use of the subsidiary activities in a proportion different from its neighbor.

It is obvious, therefore, that work done at one such "production center" costs more or less than work done at another center which makes a different demand on the "services" to production maintained by the plant. To ignore these differences and keep track only of wage cost is a backward step.

Under the old-fashioned methods of lumping all the indirect costs into one general fund called burden, and then expressing this as a percentage of labor, there is something to be said for Mr. Edtterson's plan, which has the advantage of simplicity though not of thoroughness or accuracy. But since the introduction of the "scientific" machine rate, in 1900, these percentage methods are falling into disuse, and most modern authorities on cost accounting favor the machine-hour plan.

If Mr. Edtterson will refer to the two books, "Proper Distribution of the Expense Burden" and "Production Factors in Works Management," he will probably be inclined to take a new view of the importance of connecting burden with job costs, instead of seeking to divorce them.

A. HAMILTON CHURCH.
New York, N. Y.

Is a Simple Lathe Impracticable?

While my opinions are not entirely in accord with those expressed by A. L. Pratt in Vol. 36, page 500, and your editorial, page 519, they nevertheless answer the above question in the negative.

In the act of simplifying the lathe, I would do away with the screw-cutting feature and with 48 of the 57 varieties of speeds and feeds, but I believe, from experience, that the spindle bearings should get their increase in projected area partly from additional length as well as from a larger diameter. Stiffness and rigidity are among the first essentials to be considered in this "simple lathe." I would suggest making the length of the spindle bearings about one and one-half times the diameter and with some positive, sight-feeding lubrication system.

All of the gears should be of coarse pitch and well housed. The clutch for both feeds should be large enough to give feeds that were positive and all shafts, studs, and bearings should be increased proportionally.

Believing the four reasons advanced by Mr. Pratt supporting the advantages of the "simple lathe," from the engineering and mechanical viewpoint, to be logical and well founded, I venture to add the fifth advantage from the tool manufacturer's side of the question. Modern manufacturing methods have reached a place where the capacity of the standard lathe is almost entirely inadequate and there is already a demand for a "simple lathe," which must be met.

The demand is so great that the question of sales is at once disposed of and the initial investment of the machine-tool builder would be low in comparison to that required for the manufacture of the standard lathe of the same general dimensions. So, the only question arising in this connection is, "Who will be

the first to come out from the crowd and be the pioneers?"

I have used high-speed steel for tailstock centers for extremely heavy work. We recently had a number of 4x4-in. machine-steel shafts, the weight of which was approximately 900 lb., to turn down at each end for a bearing 18 in. in length and 3¾ in. in diameter. The work was done on a 20-in. extra heavy lathe fitted out with high-speed, forged cutting tools. The work was well supported in a cathead on the steady-rest, but owing to the vibration caused by the intermittent cut, the regular tailstock centers failed repeatedly after a very short time.

The tailstock center was then taken out and annealed, and after having a hole drilled in the large end to a depth of about 3 in., it was heated to a cherry red and a piece of ⅝ round, high-speed steel was pressed into the hole and roughly ground to shape. After being trued up, it was tried out and it finished the job without having any other attention than the usual white-lead lubrication. This center has been in service for several years continuously and has shown no signs of failure. S. R. HUNTER.

Sioux City, Iowa.

Spring Length and Diameter

In Vol. 36, page 531, P. Steiner submits a problem calling for the length of a flat spring ⅛ in. thick, wound 3½ times around a 1¼-in. arbor, also the smallest inside diameter of the spring case.

Were this simply a matter of figures it would be easy, but there is at least one thing that Mr. Steiner may have possibly overlooked; that is the temper of the spring.

Should the spring be drawn to 600 deg. or slightly lower it will be very flexible and the spring case, to allow the spring to open freely, will be of a certain size; if however, the spring should be drawn only to 595 deg. it will be somewhat stiffer and the coils in expanding will require a larger spring case, possibly 0.010 in. larger.

The correct answer to this can only be secured in the way that Thomas A. Edison once found the correct capacity of a tank at his laboratory. Wishing to know this he sent a draftsman to determine it and report to him. He also sent a second draftsman, that he might be sure of its size. Upon comparison he found that the reports did not agree. He, therefore, dispatched both together, advising them of their previous report and cautioning them to be correct in their finding.

When the final report came in Edison disputed their figures. The draftsmen, insisted that they were right; but Edison setting down a certain figure stated the tank held that number of gallons. The two men going over their figures again found that no mistake had been made, they asked Edison why he was so sure that he was right and that they were wrong. He replied that wishing to know positively the capacity of the tank, he had filled it with water and then measured the water.

New York, N. Y. ED. DOBBINS.

Utility of Projecting Studs

The suggestion of E. A. Battell in Vol. 36, page 439 to eliminate projecting foundation bolts is worthy of consideration, for the reason that the usual foundation bolt projecting above the nut is a source of danger and is unsightly. The very best reason for the use of a foundation bolt which does not extend above the top of the concrete foundation has been overlooked, however.

In the erection of machinery, more especially in heavy units, foundation bolts extending above the foundation are an unqualified nuisance. The machine must be jacked up sufficiently high so that it can be lowered onto the foundation bolts, and where the bolt bosses are high, this involves extra labor and expense. With the bolt arrangement suggested by Mr. Battell, the machine can be slid along on the foundation and set into place with a minimum of labor. The suggestion will appeal to the erector.

Holyoke, Mass. W. M. FLEMING.

Vibration Recorder Wanted

Your description of the Frahm Tachometer, in Vol. 36, page 319, is interesting and also provokes me to ask for information leading to the discovery of another instrument, one that has always been in the long-felt-want class so far as I know.

The wanted instrument is one to measure and make known a few of the chief characteristics of machine vibrations, such as frequency, violence and direction. If the desired instrument would definitely locate the center of vibration in the case of a machine of other than the simplest construction, that in itself would be quite worth while.

Can any of the AMERICAN MACHINIST readers help to a knowledge of such an instrument?

WM. S. ROWELL.

Hamilton, Ontario.

Rope Pull Including Friction of Pulleys

In reading Mr. Englert's article on the above subject, page 1228, Vol. 35, it seemed to me that the assumption in the beginning that the loss in friction at each turn of the rope is 6 per cent., while it may be customary, should either be proved or else authority cited. Again, it seems to me that this percentage of loss must vary greatly with the size of the sheave, and its condition. If the author could be persuaded to go into the matter from a somewhat more scientific standpoint and then to tabulate the values of his constants for all conditions or a range of conditions, as he has for this one, he would have an article which would be much more valuable.

Worcester, Mass. E. H. FISH.

The "Production Man"

It was a delight for me to read A. L. Haas' article on "Industrial Perspective," in the AMERICAN MACHINIST, Vol. 36, page 463, as it just what I have long advocated. I believe that every concern employing over a certain number of men, should have a man attached to its executive staff whose position should be a roving one. Some firms have already done this and the man assigned to the position is called the "Production man."

Not only does this position require a thorough mechanic, but he must be resourceful and a born diplomat, able to meet the thousand and one problems which arise daily. It is surprising to see how many different controversies can be amicably settled and how loose ends of the business can be brought together by the right man.

That the right man is not easy to find is admitted but it is worth experiment, as it has been demonstrated that it pays.

Brooklyn, N. Y. GEORGE MYERS.

Hardening Steel

Referring to the article by D. K. Beans, page 310 regarding difficulties encountered with steel of low percentage of carbon, I wish to say that I have had the same trouble several times.

The cause is that the steel has become somewhat decarbonized by heating to 1650 deg. F. for eight hours. To overcome this, carbonize the steel in granulated charred bone, heat steadily to 1400 deg. F. for fully ten hours, allow to cool, and carbonize again using the same kind of material, and heat from four to five hours, according to the size of the piece, to 1250 deg. F., quench directly from the receptacle in which it is packed in a solution of 10 per cent. caustic soda.

You will then find that you have sufficient hardness to withstand 90 on the scleroscope. This method I have never known to fail.

Woodhaven, N. Y. L. R. DAVIES.

In its test on Mar. 23 in a rough sea and brisk wind off the Maine coast, the government-built battleship "Florida," by attaining a speed of 22.54 knots, set a world's record. The British dreadnaught "Vanguard" heretofore held this record with a speed of 22.50 knots. The "Florida" was built at the New York Navy Yard under the supervision of Naval Constructor William J. Baxter. Her normal displacement is 21,825 tons, and she is manned by about 900 officers and men.

Fire Protection in Plants

By A. H. Bullard*

Immediately following the Baltimore conflagration, in 1904, the Fire Insurance Underwriters instituted a very thorough campaign of inspection of cities, with the object in view of reducing the fire waste.

The recommendations of the inspecting committee were acted upon by the various municipal authorities and large sums of money expended to provide better facilities for coping with fire, but notwithstanding the improved conditions of fire and water departments the loss still continues to increase. This increase indicates that we have not found the root of the trouble, or rather that we are perhaps trying to apply a remedy without giving due consideration to the cause.

As our fire losses per capita are several times as great as those in foreign countries, it seems reasonable to presume that we are at fault, particularly so when we realize that our facilities for combating fire are much superior to those in foreign countries.

This wide difference is, to a degree, accounted for by building construction, but as the inflammable contents are the same in both cases, the thought is suggested that we are more careless in the handling of such commodities and more lax in our methods of "housekeeping," referring more particularly to negligence in allowing refuse to accumulate, and that our enormous loss may thereby be accounted for.

An 89 per Cent. Saving in 10 Years

That it is possible to control this waste is demonstrated by the records of the Factory Mutual Fire Insurance Companies, which records cover a period of over 60 years. The losses reported by these companies for the first 10 years averaged $0.3341 for each $100 of insurance, while for the last 10 years this was reduced to $0.0373, a saving of approximately 89 per cent.

This saving has been made possible by the use of automatic sprinklers and regular inspectors of risks, with the requirements that prescribed standards shall be maintained.

The moneys we may receive from insurance in case of fire are but slight compensation for loss of business, and it should therefore be our aim to so protect ourselves that we are virtually immune from the ravages of fire.

When erecting new plants, modern methods of construction may be carefully considered, but the situation with which we are confronted is what can and should be done in the way of fire prevention in the buildings now being used, and which cannot be abandoned on account of the expense.

While the installation of automatic sprinklers without doubt furnishes the very best protection, and such an equipment is earnestly recommended, conditions may be vastly improved by placing fire pails and fire extinguishers at frequent intervals and in convenient places. Stand pipes with hose connections are also very desirable, and suitable tanks for holding oils and extreme care in their use is a wise precaution. As a protection from exposure suitable fire shutters or wire-glass windows are quite necessary.

Fire escapes, so constructed as to permit of ready exit, should be provided in sufficient numbers to allow all employees to leave the building without delay.

Precautions Important

Nothing can be of more importance than tidy housekeeping and systematic inspection, and this is possible in all plants, old or new, and at a minimum cost. Someone should be appointed, whose duty it is to make monthly, preferably weekly, inspections of the entire plant for the explicit purpose of observing whether the general cleanliness is in accordance with the instructions, and to see that all fire appliances are in good order.

The better to insure attention to all details, an inspection book may be provided, in which the several items needing attention shall be noted according to the location on the premises.

Fire pails should be checked as to location, and as to whether they may or may not be properly filled with water; it will be surprising to see how often they are found to be in need of attention.

Fire extinguishers should have a tag, on which should be noted the date when last charged with chemicals, and the covers should occasionally be removed to ascertain whether needing attention. If the bottle, which was originally half filled with acid has absorbed sufficient moisture, so that it is found three-quarters full, it is time to recharge the extinguishers.

Fire doors should be examined, to see that hinges and latches are in good condition, and the fusible links on self-closing doors should be examined, for it frequently happens that these links break and a piece of wire may be used for their repair, thus preventing the self-closing in case of fire, and further, materials are many times found to be so placed that the door cannot be closed.

General cleanliness of the shop should be noted and particular attention given to the accumulation of rubbish or oily waste.

Windows, or avenues leading thereto, should not be obstructed by stock, thus making it impossible for employees to escape in case of necessity, or for the fire department to gain an entrance. Fire-alarm and watchman's boxes should also always be accessible. Oily waste should never be allowed to accumulate, and proper receptacles should be provided for holding it until gathered up and burned.

Too much care cannot be exercised in checking up electric wiring, particularly lamp cords, which are often found hung over a revolving shaft. Each plant has its own particular hazardous points, which should be listed and checked in addition to these general suggestions. A memorandum of defects should be promptly given to the proper authority, who should see that they are corrected without delay.

Such a system of inspection as outlined will invariably show that something about the plant needs attention, and although usually of a trivial nature, the minor matters unattended to quickly reach such proportions as to create extremely hazardous conditions.

*Secretary and Treasurer, Bullard Machine Tool Co.

Reports on Navy-Yard Management

The Committee on Naval Affairs of the House of Representatives has caused to be printed three reports dealing with navy-yard management. These are: Report of Civilian Expert Board on Industrial Management of United States Navy Yards; Report of Vreeland Board on Modern Navy Yard Methods; Report on the Vickers System of Industrial Management.

These reports are too long to review or abstract in detail, and only a few conclusions and recommendations can be given here. They will prove interesting reading, however, to anyone having to do with shop management and desirous of getting different viewpoints of an important subject.

General Recommendations of the Civilian Board

We have investigated the question of the work that should be done at the navy yards, and believe:

(a) That only such repairs should be made at the yards as cannot be made at sea.

(b) That a material reduction should be made in extensive repairs and alterations to old vessels, as compared with past policy.

(c) That the decision to build new vessels at the navy yards should be determined upon its own merits and not for the purpose of maintaining a trained force of employees.

(d) That manufacturing work should be limited to cases where trade conditions or the development of new types of apparatus make it imperative.

(e) That the adoption of the above policies would result in material reduction in navy-yard work and make it desirable to concentrate the work done now by the Machinery and Hull Divisions at fewer yards; and having pointed out the similarity underlying the methods which are now being used by the fleet to those which should be adopted by the yards, we summarize our recommendations as follows:

1. That a thorough investigation be made to determine as accurately as possible the character of work and other

service which should be handled at navy yards.

2. That a thorough investigation be made to determine which yards are needed to properly serve the fleet in connection with the above work and service.

3. That scientific management be introduced and perpetuated in the navy yards which it is decided to operate.

The following plan of procedure is recommended for the introduction and perpetuation of scientific management:

(a) The creation and development of a central organization, headed by the officer of the navy best suited for such work, to develop and perpetuate scientific management in the navy yards.

(b) The segregation and management by the central organization of the following matters: All questions in regard to labor at the navy yards; navy-yard equipment, buildings, and power plants, and possibly dry-docks, wharves, and public works at navy yards; administration of all navy-yard work; preparation of estimates for, and expenditures of appropriations for this work.

(c) The introduction of scientific management into the shops at Annapolis and the establishment of a course of instruction in the class room.

(d) The provision by this organization for the training of all graduates of the Naval Academy for at least one year as apprentices in the shops of the navy yards, preferably after one year of sea duty.

(e) The selection of men for the central organization and the managerial force in the navy yards from the available officers who have had the requisite general training and who show ability and preference for this work. These officers should be assigned to permanent managerial duty, subject only to termination by the director of the central organization or the Secretary of the Navy.

These recommendations are considered individually and at some length. In order to bring about the desired conditions, three methods have been considered:

1. The provision of a separate corps for each class of specialists, one of which would be the manager.

2. The provision of one separate corps, including all specialists, one of which would be the manager.

3. The provisions of but a single class of officers, which would include all specialists within its ranks.

Any one of these plans is feasible, but we believe the last would develop a more efficient personnel and effect more complete coöperation. The measure of success attained under this plan will depend, however, largely upon the manner in which the details are worked out and upon the judgment exercised by the principal executives of the Navy Department when making appointments. In every instance the actual requirements of the work, and not the fact that one or more officers are available, should govern appointments.

Unsatisfactory Present Results

The present ineffectiveness of the yards is referred to in this strong statement:

The efficiency with which the work is handled in the navy yards visited by us, when considered as a whole, does not compare favorably with the results secured in well managed industrial plants. Notwithstanding the fact that the large equipment is adequate in the main and that many items of overhead expense, which must be borne by industrial plants are not charged to government work, the results are costly and slow.

The reduction in labor cost that the committee believes possible by introducing scientific management is one-half.

We are convinced that when the navy-yard work is fully standardized and planned it will be done for one-half the present cost, not including materials, notwithstanding the fact that the type of management which we have recommended provides greater individual compensation for the workmen and much more regular employment.

The Vreeland Report

The Vreeland report outlines three schemes of navy-yard methods, and discusses them in detail.

The Vickers Report

One part of the third report was written by Rear Admiral A. B. Willitts, and deals with the question of management in the manufacture of guns. From this we quote three paragraphs dealing with modern or scientific shop management:

No theories, however alluring, should be permitted to obscure the paramount value of practical common sense as a guide in adopting any feature of reorganization of shop management. With all the literature on the subject now available, intelligent managers do not need either the assistance of a genius or the services of an expert to enable them to modify their methods apace with the advancing knowledge of needs and in a manner best suited to the special conditions of their plant and work.

F. W. Taylor's agitation of the whole subject of shop management awakened the industrial world to a realization of the great accumulative wastes common under the old methods and attributable to lack of systematic provision of, and provision for, the needs of manufacture in detail; and while his theories reach into the Utopian atmosphere, the promulgation of his views has had widespread influence in effecting economies.

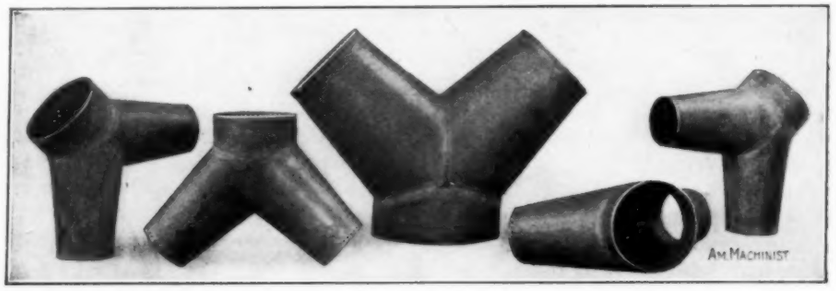
But it does not follow that the enthusiastic pioneer is the best road builder, and, after a very deliberative study of the various systems of management in the large gun factories, I am forced to the opinion that the Taylor system is an elaboration far beyond the necessities for securing a perfectly satisfactory operation of any large plant, and that, in its entirety, it is neither best suited to nor desirable for navy yards or the Washington Gun Factory.

Unusual Examples of Oxyacetylene Welding

By L. H. Burkhart

The halftone shows a very neat welding job done by the Struthers-Wells Co., Warren, Penn.

The Ys shown were ordered along with a large quantity of pipe. The plate for the Ys is laid out in the usual way except that no allowance is made for laps and flanges, as in the riveted product. After the plates are formed into shape they are tacked together with the oxyacetylene blowpipe ready for the final welding.



An Oxyacetylene Welding Job

The welded construction avoids the necessity of either buttstrapping the joint between the two branches or double flanging it for rivets, in fact there is no flanging required for any of the seams, which saves considerable time in fitting up and makes all seams smooth and tight without the necessity of calking. The absence of rivet heads and edges of plate makes a more desirable construction, as it offers less resistance to the flow of water.

Reversible Steam Turbine

Another step has been taken in the perfection of the turbine, says the London *Standard*. Experiments and demonstrations have been made by Wainwright Brown on a reversible steam-turbine model 30 ft. long and about 18 ft. in breadth. It is reversed from full speed in one direction to full speed in another in a few seconds.

The reversing is effected by synchronized disks rotated by screw spindles extending outside the turbine casing which are made to open or close by nozzles which give the steam a left or right direction upon the blades.

Designs are now under preparation for the construction of a 2000-hp. machine on the new principle. It is the purpose of the inventor to adapt all sizes for the use of gas in place of steam.

Several large steamship companies have the new invention under consideration as a means whereby to increase the speed of their fast ocean-going liners.

Educating Foremen in the Shop

By Otto Stolzenberg*

Two winter courses are provided, consecutively, a preliminary and an advanced. Each requires 100 hours. Some 30 men are admitted each year, and the course is in high favor.

An outline is given of the subjects taught.

*Superintendent of Apprentices, Ludwig Loewe & Co., Berlin, Germany.

It was permitted me some time ago to report in Vol. 33, page 832, on the education of apprentices by Ludwig Loewe & Co., of Berlin, Germany. Not less important is the problem of instructing the foremen. One often hears complaint that it is difficult to find competent foremen. And indeed there is a constant demand for capable foremen in all branches of the machine industry.

If the question be raised: "What qualities are desired in a good foreman?" it may be answered: Most important of all are the right qualities of character. As a trusted official of the firm, the man must be honorable, wise and reliable. He must possess the necessary authority over the workmen, showing himself sure and determined. But qualities of character alone will not do. The foreman must also have trade knowledge, he must understand practical work at least as well as the best of the employees under him. And there is still a third requisite: He must command the theoretical knowledge of his trade.

Here, therefore, we have a whole quantity of requirements imposed upon a good foreman. While the character is formed "in the stream of the world," and the shop practice can only be acquired through years of work in the shop, there are different ways by which the necessary theoretical knowledge can be gained. All of them are resorted to. One man buys books, another attends night schools, while another, perhaps, interrupts his activity for one or more years in order to take a course in a "foremen's school" proper. The quickest method, however—the theoretical education of the foreman by the factory itself—is still little resorted to. However, this is the most convenient and the surest way.

It would, perhaps, be interesting to learn about the organization of such a foreman's course in its details in the machine industry. Therefore the following brief account is given of the foremen's course at Ludwig Loewe & Co.'s plant.

FIG. 1. FOREMEN'S CLASSROOM OF LUDWIG LOEWE & CO.

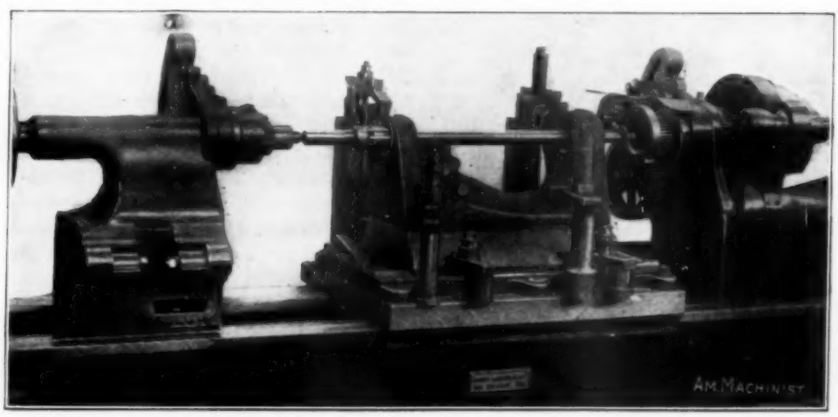


FIG. 2. A SET-UP USED IN THE COURSE FOR SHOP FOREMEN

THE LOEWE COURSES

The courses are held every winter, summer being found less suitable for the purpose, and about 30 participants are admitted. They must give information as to their previous lives and preliminary education. The list of candidates for foremen is brought to the attention of the proper works officials with a possibility of rejection of the application by them. It is found advisable to require a tuition fee at the start, on the ground that a free privilege is less highly prized than one which has to be acquired. This money can be returned to successful participants at the end of the course, while the sums forfeited may be used as a premium for the most proficient. The classroom and its equipment are shown in Fig. 1. Fig. 2 is typical of the practical illustrations afforded foremen by the curriculum. The most advanced practice is thus demonstrated. The period of instruction at the Loewe works amounts to four hours a week in two-hour periods after working hours. Since the shops close about a quarter past five, the instruction begins about half past five and lasts till half past seven. A course, therefore, embraces about 100 hours.

Year by year there is given alternately a preliminary and an advanced course. To the upper course are admitted only those who have successfully completed the lower one.

THE SUBJECTS TAUGHT

As regards the detailed subjects of instruction in the first course, particular stress is laid upon workshop arithmetic and training in calculation. The term "workshop arithmetic" indicates how much importance is attached to the practical use of computation. Here, for example, are treated: The use of charts, use of the slide rule, calculation of weights, computation of change gears.

The practical calculations are made on the basis of sketches. In this manner is

determined the cost of a series of pieces of work. Another branch of instruction conveys the fundamental laws of physics and mechanics. Here, among other things, instruction is given on cutting speeds, gear systems and capacity of machines.

With the aid of photographs are discussed the production of materials, the manufacture of pig iron, refining, puddling, Bessemer, Thomas and Siemens-Martin processes, etc. Especial attention is given to the use of materials in the shop and to tests of materials. At the same time practical tests of material are undertaken in the laboratories. There is often a systematic discussion on correct working methods.

Since the foreman must be able, before all things, to read drawings and to lay down his own ideas in a sketch, several hours are also devoted to sketching of machine parts and fixtures.

The advanced course, which likewise embraces 100 hours, is especially concerned with the theoretical and practical calculation of work and with the figuring cost of manufacture. There is also given a survey of labor law. Of great importance for the prospective foreman are the legal rules of notice and discharge, wage payment, employment of juveniles, safety provisions and many other matters.

The management of the course rests in the hands of the superintendent of apprentices and of the apprenticeship school. Beside him, instruction is imparted by numerous leading officials of the works in various departments, each in his own specialty. Even the general manager of the works does not hold himself too good to impart his experience and knowledge to the workmen in this manner.

It should be evident without further remark, that such arrangements as are found in the foremen's course, if rightly carried out, can be of the greatest benefit to a factory. Even if it had no other purpose than to discover the actually clever men, this would suffice to show its value. Naturally the instruction of the foremen is a great favor to them and under proper conditions, it may be used competitively among them. The participants who go out from this course in the Loewe works prove very efficient men.

Elasticity of Machine Parts

By A. R. Vance

The subject of elasticity of metals has been very fully demonstrated in connection with structural work, but very little information is available as to the deflection of parts of machine tools under load. This matter should receive more attention than it has in the past, on account of the severe duty imposed on the working parts by the use of high-speed steels and also in special machinery operating at a high speed.

For example, consider the change gears for varying the speeds of spindle and the feeds of the work table. These are ordinarily calculated on the basis of the strength of the tooth plus a factor, more or less empirical, depending on experience. The results are not satisfactory, as may be noted on almost any high-speed machine, the gears being noisy, and sometimes there is excessive wear, showing that something is wrong in the construction.

It has been shown by many authorities that it requires the best workmanship to produce satisfactory gearing. But assuming that the tooth form is as nearly correct as is practicable to make it if the body of the gear deflects, in case of a bevel gear, or the tooth itself deflects, in case of a spur gear, when under power, the gearing will be noisy and the wear excessive.

Determining Tooth Sizes

The size of the teeth should be determined not from the strength of the tooth, but from its deflection under running conditions, developing the power required. This would take care of the strength of the teeth, as the size of the tooth would be larger than if determined by strength alone.

It is reasonable to suppose that a larger tooth should be used than now obtains for a given work, not for the reason that coarse-pitch gears run more quietly than fine-pitch gears, because it is well known that the smaller the teeth the closer they approach rolling contact and the smoother the action, but simply to increase the size of the tooth so as to reduce deflection to a minimum, thus getting the full benefit of the tooth form.

It seems that the amount of deflection to be allowed should be the same or less than the limits obtained in the several dimensions of the teeth, as made by manufacturers making a specialty of gearing. As an experiment, mount two standard spur gears on a flat plate, on pins ground to fit the holes, one gear blocked so that it cannot turn the other, arranged with a lever fastened to the gear, free to turn on the ground pin without play, and load the lever to take up the backlash. Then load the lever to produce the required load on the teeth, and it will be found that the point of the driving-gear tooth, next to the tooth that is fully in mesh, will bear so hard against its mating tooth, due to deflection, that it causes excessive friction and noise when running at high speed.

A pair of spur gears were tested in this manner and then the pitch increased to get rid of the deflection as much as practicable. The results were very satisfactory, there being very little noise compared with that made by the original gears, and the wear was not appreciable during a year's constant use. Practically, this amounts to using the next coarser-pitch cutter that can be obtained commercially.

In bevel gears, when mounted properly and the load applied as before stated, a multiplying indicator, applied to the back of the rim opposite the driving pinion, shows a deflection of the rim of the gear laterally due to the side pressure of the pinion teeth. This refers, of course, to web bevel gears, the diameter of which is sensibly larger than their hubs and the rims of which are not sufficiently braced with ribs; a condition that obtains in numerous designs now in commercial use.

Studs and shafts for driving gears, when they have an appreciable overhang from the bearing, as is found in many machines, cause trouble by deflecting under load an amount not sufficient to cause breakage but enough to make gears noisy. Brackets supporting these studs and shafts, that are supposed to be amply stiff and rigid, often develop surprising deflections in operating under load.

It is very difficult to give specific examples of this matter, as it is modified by many conditions, depending on design and workmanship; but the fact remains that these parts deflect in machines as ordinarily constructed, and if this subject is given the consideration its importance warrants, much improvement can be made.

Compression of Cast-iron Members

Another subject closely related to the deflection of parts is found in cast-iron members, levers, cam arms and similar parts, that are keyed to steel shafts. These members are subject to shock during operation, but the stresses developed by these shocks are not, however, sufficient in themselves to require the members to be made of steel.

After these members have been in use for some time, the keys which were fitted practically tight will be found quite loose, and interfering with the proper operation of the machine. This is due to the compression of the member against the side of the key.

Cast iron, even of the hardest grade, is more or less porous, takes a permanent set, leaving the keyway wider than originally made. This trouble has occurred time and again, even when the area of bearing against the key is made sufficient to carry the load. This is found to be very satisfactory in cases where the keyway has obtained its permanent set by having a new key fitted without removing any metal from the cast-iron member. The matter of elasticity is so important that it seems proper to call the attention of designers and manufacturers to the conditions, as they are found in actual use. This matter develops largely in high-speed machines and tools, but is found even in moderate-speed tools.

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OUTLINE OF TOPICS, PAGE 153

American Machinist

Where Contracts Begin and End

A great deal of the trouble and loss in the fulfillment of contracts is occasioned by misunderstandings in relation to contract terms. This is particularly true in cases of divided responsibility, when various parts of the material are to be furnished by different contractors. Where these come together in the complete structure, or machinery installation, or what not, there are often certain connections which might be supplied by either party; and it is, therefore, necessary to specify in the contract just by whom they are to be furnished.

Two, at least of the leading manufacturers of hydraulic machinery have evolved a contract form which is especially intended to obviate misunderstandings of the nature referred to. At the top of the first sheet, following the names and addresses of the contracting parties, subject, etc., are written the words, "This contract begins with . . . ." while at the close it is specified that "This contract ends . . . ." with whatever marks the exact termination of the work or the passing of it on to another contractor. In every case the connecting details, such as shaft, coupling, foundation plate, bend, flange, bolts, etc., are carefully specified.

The same idea is carried into the execution of drawings. At all points of connection, as, for example, in the piping scheme, an arrow is lightly drawn across the place which marks the boundary of the contract and a suitable legend inserted to the effect that the contractor's responsibility begins or ends there.

This is of greater importance than in the printed or typewritten contract form, for, while the latter is usually checked over at the time of approval and then filed away, the drawings are in constant use, and the purchaser gets his most lasting impression from them. Furthermore, they pass into the hands of superintendents, foremen, erectors and others who have no means of knowing the exact contract terms, but depend upon the details shown in the construction and installation plans. So far as these are furnished by manufacturers of material or equipment, they are verp apt to be misleading. The average designer dislikes to leave anything in an unfinished state; hence, at points of connection, he is likely to have enough drawn in to indicate what lies beyond. This is right and helpful in the subsequent interpretation of the drawings with relation to other plans, but where a coupling, flange or pipe connection, not covered by the contract, is thus shown, the fact should, in some manner, be plainly indicated.

The danger of misunderstanding is accentuated by the prevailing tendency to place contracts for the main features of construction or equipment and leave minor details to be supplied as needed. Not a few of these are connecting links, and it is frequently discovered, as work nears its close, that final completion will be delayed until certain details, which, it was assumed by those who had checked the drawings, would be furnished by contractors, could be ordered and delivery secured.

There probably are few men of practical erecting or operating experience who have not had this difficulty to contend with, and, when at a distance from the base of supplies, have found it particularly aggravating. The innovation mentioned will, therefore, be welcomed by men of this class, and may at times prevent serious loss from otherwise unavoidable delays.

Anything that tends to a clearer understanding of what is wanted, of what is to be done, is worth while. This is, therefore, well worth while.

Fire Prevention

One of the great present-day problems before American industry and American engineers is the reducing of our appalling annual fire waste. What is the remedy, particularly in manufacturing plants? An article on page 765 gives the answer—*prevention.*

It is the duty of the superintendent and manager of every plant to surround his buildings, their equipment, and contents with all reasonable safeguards to prevent fire. Today, only very unusual conditions can defend the use of combustible materials in the factory construction. Factory buildings should be of fire-resisting materials.

Means of fighting fires—sprinklers, stand-pipes, hose connections, fire extinguishers, and pails—should be provided in keeping with the needs. Cleanliness and orderliness are of the first importance. Finally, intelligent, periodic inspection should be insisted upon. All of these things have to do with prevention.

The customers of a factory have as vital an interest in these provisions as the owners. A plant constructed and equipped to prevent fires, is an added guarantee to the purchasers of the product turned out that contracts entered into will be fulfilled. A customer has the right to ask: "What do you do to prevent fires in your shop?" There have been cases where the giving or withholding of a valuable order depended upon the answer to that question.

Effectiveness vs. Efficiency

The word efficiency, which has long been defined as the producing effect of a machine, latterly has been applied to human effort. This application of the term to the worker is suggestive of the inanimate—the machine. Is there not danger then that the constant use of the word in connection with the worker will increase the tendency to regard him as only a mechanism—a unit of production? Could not *effectiveness*—the ability to work to an end—be applied to the man, and *efficiency* rather be left in its original reference to the machine? Efficiency suggests merely relation between output and given available resources, while effectiveness implies, in a degree at least, progress and possibilities.

With all the modern tendency toward increased production, improved methods, and even the so called scientific management, cannot the older ideas regarding the worker as possessing an individuality, with a destiny to be worked out, be

retained, in lieu of the machine thought-cogs in a huge mechanism? Why not concede to each worker the personality of the man, favoring those interests which to him mean everything promoting his welfare through the greater destiny of self-respect?

A little study now and then; helpful and constructive conversation at all times; or, in brief, self-improvement, tending at all times to that same self-respect which is an unquestionable right —these things progress in the direction of that greater effectiveness which is beyond mere mechanical efficiency. With a proper balance of working regulations, efficiency may be assigned to the machine, and man placed on a higher level, to be known and recognized by his effectiveness in the shop and the world at large.

The Patent Bill

The patent bill introduced simultaneously into both branches of Congress contains a number of provisions that will completely change or modify present patent practice. A few of these that are worthy of our support are mentioned below. The purpose of the bill is to codify, revise and amend the laws relating to patents. Thus it is comprehensive in its scope.

Everyone interested in the patent situation and desirous of seeing constructive reforms put into effect, should acquaint himself with all of the provisions.

At present the Patent Office is a bureau of the Department of the Interior. This bill makes it independent of any of the departments. It provides for a commissioner, first assistant commissioner, assistant commissioner and three examiners in chief, who are to be appointed by the President with the advice and approval of the Senate.

These six men are to constitute the Board of Appeals; any three of them shall constitute a quorum. The duties of this board are to review and determine the validity of the adverse decisions of examiners upon applications for patents, and for reissues of patents and in interference cases.

The life of a patent is left unchanged —seventeen years. But every patent must expire at the end of nineteen years from the date of filing its application in this country, exclusive of the time actually consumed by the Patent Office or the courts in considering the application, and where the application has been involved in interference, of the actual time in which it has been so involved. In no case shall a patent be in force more than seventeen years.

In case a patent is not worked in the United States after the first four years by the owner or persons authorized by him, any person demanding it shall be entitled to a license from the owner to manufacture the invention or to carry on the patent process, unless the owner shall show sufficient cause for such inaction. If the owner refuses the license, the person seeking it may appeal to the district court having jurisdiction. The court is to hear the parties and if it deems that the reasonable requirements of the public in using the invention have not been satisfied, it can order a license to be issued, fix the royalties and method of their payment.

All applications for patents shall be completed and prepared for examination within six months after filing the application. In default thereof or upon failure to prosecute within six months after any action, of which notice shall have been given to the applicant, the application shall be regarded as abandoned. It cannot be revived unless it is shown to the satisfaction of the commissioner that the delay was unavoidable.

The present fees for application and issue are reversed. The former is to be $20, the latter $15. The provisions cited are those aimed to correct the most-often-referred-to- abuses.

They provide for one instead of three bodies to which appeals can be taken in the office, limit the life of a patent from the date of filing instead of merely from the date of issue, provide means for compulsory licensing of a "shelved" patent, shorten the period between actions to six months and increase the first fee by $5 and decrease the second by the same amount.

All of these provisions seem wise. But as this is a nonpartisan bill everyone interested in its passage should write to his representative and senator urging its passage.

The House bill is R. H. 23,193; the Senate bill is S. 6273.

New Publications

FOUNDRY PRACTICE. By R. H. Palmer. 287 pages, 5x8 in., 154 illustrations, together with a 10-page glossary and an appendix containing 40 tables. John Wiley & Sons, New York City. Price, $2.

This book, written by a practical molder who has had charge of foundries, and was formerly instructor in foundry practice in the Worcester Polytechnic Institute, is intended more as a textbook for the student or apprentice than as a reference book for the finished foundryman, and the book follows the scheme of instruction used by the author in his school work.

Beginning with the simplest form of mold, the book leads gradually up through the more difficult lines of work in green and dry sand, and loam. Only enough typical examples have been used to clearly illustrate the class of work to which they belong, and not so many as to confuse the reader, as is often the case.

Practical work to supplement the book instruction is strongly urged. Besides the molding instruction contained, the book also includes cupola practice, mixing, melting, cleaning and repairing of castings, and other kindred subjects.

Mechanical Engineers Spring Meeting

The following tentative program has been announced for the spring meeting of the American Society of Mechanical Engineers to be held at the Hotel Hollenden, Cleveland, O., on May 28 to 31:

A New Analysis of the Cylinder Performance of Reciprocating Engines, J. Paul Clayton; Equipment of a Modern Flour Mill on a Gradual Reduction System, John F. Harrison and W. W. Nichols; Design and Mechanical Features of the California Gold Dredge, Robert E. Cranston (discussion); Problems in Natural Gas Engineering, Thomas R. Weymouth; Sound Waves: How to Photograph Them and what They Mean, Dayton C. Miller; New Processes for Chilling Cast Iron, Thomas D. West; Strength of Steel Tubes, Pipes and Cylinders Under Internal Pressure, Reid T. Stewart; On the Control of Surges in Water Conduits, W. F. Durand; Speed Regulation in Hydroelectric Plants, Wm. F. Uhl (discussion); The Present State of Development of Large Steam Turbines, A. G. Christie; A Discussion of Certain Thermal Properties of Steam, G. A. Goodenough; The Reduction in Temperature of Condensing Water Reservoirs, W. B. Ruggles; Tests on the Discharge Capacity of Safety Valves, E. F. Miller and A. B. Carhart (discussion).

Machine Tool Builders Convention

The program of the semi-annual convention of the National Machine Tool Builders' Association, to be held at Atlantic City, May 16 and 17, includes the following papers: "How Mechanical Journals Can Be Made of Most Value to Their Patrons," Fred Rogers; "The Value of the House Organ as an Advertising Medium," Charles E. Carpenter; "What the Association Can Do for Its Members," James H. Herron; "What the Future Has in Store for Us," Charles E. Hildreth.

It is announced that Fred A. Geier, president, Cincinnati Milling Machine Co., will make a report on the tariff outlook.

Hugh A. Reed

Hugh A. Reed, president of the Baird Machinery Co., Pittsburg, Penn., and one of the pioneer machine-tool men in that section, died on Apr. 25.

Mr. Reed was born in Allegheny, 58 years ago, and after a common-school education, entered the line of work in which he was destined to spend his entire life.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Pipe Bender

The special feature of the pipe bender shown is the method of forcing the pipe into the quadrant or forming die by means of a V-shaped rocker bar which supports the wall of the pipe at the point of bending, eliminating any tendency to crowd or flatten.

The quadrant shown at *A* is internally geared and carries the block with the roller *B*. The roller is forced against the V-bar *C*, forcing the pipe around the quadrant *D*, which remains stationary. The pipe, it will be seen, is supported at all times at the point of bending, without any crowding effect.

PIPE BENDER

While a radius of 14 in., or greater, for pipe as large as 2 in., is recommended, the machine has been successfully used for a radius as small as 9 in. on 2-in. pipe; 8 in. on 1½-in. pipe; 6 in. on 1¼-in. pipe; and 4 in. on 1-in. pipe.

The machine is adapted for an endless variety of shapes, and coated pipe is handled without fracture.

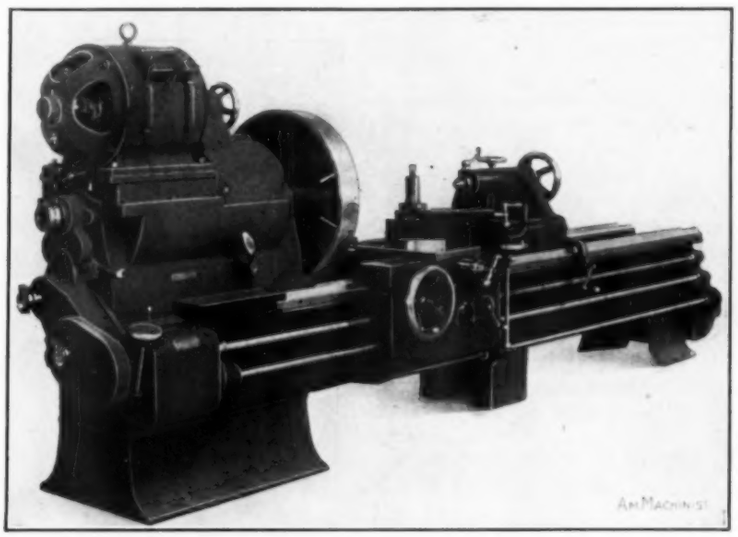
The machine weighs 811 lb. and is a recent development of the Wallace Supply Co., 108 N. Jefferson St., Chicago, Ill.

A Motor Driven Lathe

The halftone shows a 30-in. lathe, which is one of a new line of motor-driven lathes from 13- to 30-in. swing, built by the Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.

The headstock pattern is designed to permit placing all gearing at the forward end, nearest the spindle nose, and not under the motor. The rear end is arranged for the reception of the motor, which is placed very low to avoid top-heaviness and ungainly appearance.

The head cover incloses all the gears, and thus no further gear guards are necessary. Double back gears are provided, which are shifted by means of the lever in front of the headstock. This lever is keyed to a shaft, the other end of which carries a pinion engaging a rack controlling the sliding back gears.



A MOTOR-DRIVEN LATHE

The lever for throwing the back gears in and out of engagement is located on the forward end of the headstock in a convenient position for the operator. It is provided with a positive lock to prevent the back gears jumping out of engagement when under heavy shock or stress.

An automatic locking mechanism is provided which prevents sliding the back gears except when thrown back, and also prevents throwing the gears into engagement when they are not exactly in the proper position. The spindle runs in three bearings, one of which is located in a tie piece across the middle of the headstock.

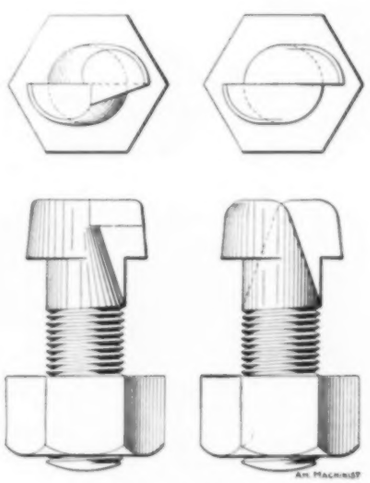
These lathes should be equipped with shunt-wound motors, preferably with commutating poles and reversing-drum controllers, with a speed range of one to three. Automatic overload and underload release-panels are also advisable. No sliding bases are necessary.

Double Hook Bolt

The design of the bolt shown is apparent from the illustration. It is made with plain and braced heads.

The bolt is designed so as to have as much metal at the smallest part near the head as it has at the base or root of the thread.

It will be seen that the head passes through a hole the same diameter as the stem of the bolt. The braced head bolt is designed for heavier strains. To apply, the heads are passed through the hole, in the case of the plain type, simultane-



DOUBLE HOOK BOLT

ously. With the braced type the braced half is passed through first.

This bolt is a recent development of the Kling Bolt Co., 42 Broadway, New York, N. Y.

Knurling Tool

The knurling tool shown requires but little explanation.

KNURLING TOOL

It has a capacity for pieces up to ¾ in. in diameter. The work is well supported by the three knurls, and the hollow handle contains an extra set of knurls.

This tool is a recent product of Edgar T. Ward & Sons Co., Boston, Mass.

Double Back Geared Engine Lathe

The 16-in. lathe shown has been designed for heavy duty. The spindle will take draw-in collets up to ⅞ in. capacity.

The tailstock is of the offset type.

The carriage has a bearing of 26¼ in. on the ways and is provided with self-oiling felt wipers.

The apron has double bearings for all shafts. All the feeds are reversed in the apron and interlock with the lead-screw nut making it impossible to engage feeds and the lead screw at the same time.

Three quick changes of feed are obtainable for each change of spindle speed.

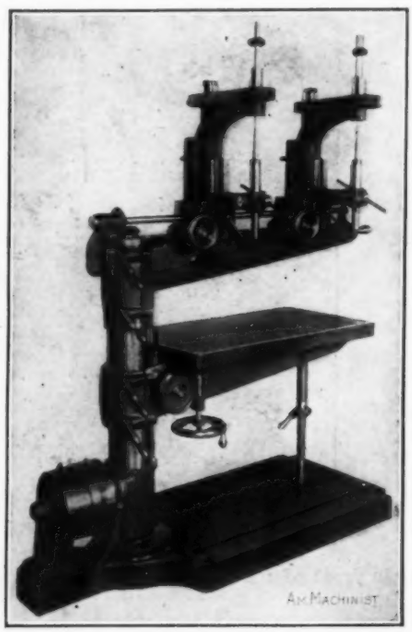
The double-friction countershaft has pulleys 12 in. in diameter for 4-in. belt.

The swing over the ways is 18½ in., over the carriage 11¾ in., and the distance between centers with 6-ft. bed is 28 inches.

This machine is a recent product of the Rockford Lathe & Drill Co., Rockford, Ill.

Radial Drilling and Tapping Machine with Two Heads

The halftone shows a radial drilling machine built by the Taylor & Fenn Co., Hartford, Conn. The one head on this machine is for drilling operations only. The other head is equipped with reversing mechanism for the spindle to be used for tapping. The construction of the machine is the same as illustrated and described in Vol. 33, Part 2, page 985, but any of the standard heads built by the concern may be applied to the radial arm. The spindles of the heads can be driven at widely different speeds where necessary, as for instance when counterboring or tapping.

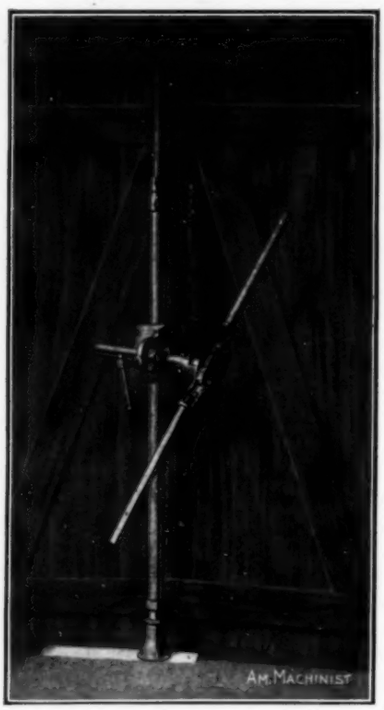


RADIAL DRILLING AND TAPPING MACHINE

Pipe Vise Post

The pipe-vise post shown herewith was designed to facilitate the setting up of pipe vises.

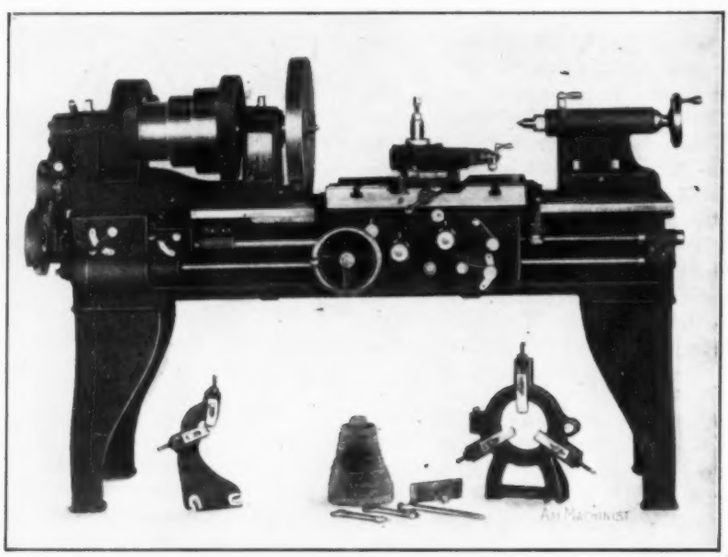
It is made of 1½-in. wrought-iron pipe slipped into 2-in. pipe. The large pipe is fitted at the top with a clamping device, which permits adjustment to a height from 6 to 11 ft. At the base of the post is a screw-jacking device, which is turned after the post is in place. A swivel at the top permits the turning of the jack screw without twisting the post out of position. Little spuds are placed in the base and head to prevent slippage.



PIPE-VISE POST

The vise is screwed in an oak block, which is fastened to the 2-in. pipe.

This post handles pipe up to 3 in. in diameter and weighs 50 lb. It is made by the Mason Machine Co., Bridgeport, Penn.



DOUBLE BACK-GEARED 16-IN. LATHE

Copper, tin, and sheet-iron products engaged 73,600 wage earners during the year 1909, according to a report just issued by the Census Bureau. This showed an increase of 92.1 per cent. over the number employed during 1899, the year of the preceding census.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

For the convenience of readers, news items in this department are arranged geographically, by states. The various states will be grouped under subheads, as follows:

New England: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

Middle Atlantic: New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia.

Southern: Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Tennessee, Kentucky.

Middle West: Ohio, Indiana, Michigan, Illinois, Wisconsin.

West of the Mississippi: Iowa, Minnesota, Kansas, Nebraska, South Dakota, North Dakota, Wyoming, Colorado, Montana, Missouri, Arkansas, Texas, Oklahoma, New Mexico.

Western States: Idaho, Utah, Nevada, Arizona, Washington, Oregon, California.

Metal Working

NEW ENGLAND STATES

The shops and water tower of the Maine Central R.R., at Brunswick, Me., were destroyed by fire, Apr. 26. P. N. Watson, Brunswick, is superintendent of buildings.

The plant of the Hub Automobile Co., 93-97 Freeport St., Boston, Mass., was damaged by fire, Apr. 24. Loss, $20,000.

Gerstein Bros. and the Cooper Co., South Boston, Mass., manufacturers of plumbers' supplies, will erect a new factory.

The contract has been awarded for the erection of the new addition to the factory of the Hendee Mfg. Co., Springfield, Mass., manufacturer of motorcycles.

W. H. Robinson & Co., Worcester, Mass., sheet-iron workers, will erect a new factory.

The contract has been awarded for the erection of the five-story pattern storage building for the Sessions Foundry Co., Bristol, Conn. Noted Apr. 4.

Fire in the mill of the Cairns Wood Working Co., East Hartford, Conn., on Apr. 12, caused a loss of $30,000. Insurance, $20,000.

Peter Christensen, Hartford, Conn., has awarded the contract for the erection of a garage, 58x86 ft., one-story, on Smith St. The building will be occupied by Sewell's Garage.

Plans are being prepared for the garage to be erected in the rear of the Dickinson Block, on Main St., New Britain, Conn., for F. K. Alford. It will be 40x52 ft., one story, of brick. Unkelbach & Perry are the architects.

The Risdon Tool & Machine Co. will erect a factory, at Naugatuck, Conn., for the manufacture of small automatic machine tools and brass specialties. George T. Wigmore, Naugatuck, is secretary.

The Kerite Insulated Wire & Cable Co. has awarded the contract for the erection of a plant, at Seymour, Conn. The building will be 40x75 ft.

MIDDLE ATLANTIC STATES

The Whylan-Nelson Motor Car Co., Buffalo, is arranging to remove its manufacturing plant to Batavia, N. Y. Frank V. Whylan, 91 Claremont Ave., Buffalo, is president.

The Morrow Mfg. Co. will build a one-story addition to its factory for the manufacture of coaster brakes, at South Main and Scott Sts., Elmira, N. Y. A. P. Morrow is president.

C. C. Pedersen, architect, Jamestown, N. Y., is preparing plans for a factory addition, 41x90 ft., one story, 29 ft. high, to be made to the plant of the Crescent Tool Co., on Harrison St., Jamestown.

The factory of the Weber-Knapp Co., Chandler St., Jamestown, N. Y., manufacturer of hardware specialties, was badly damaged by fire, on Apr. 24.

The King Fire Signal Co., Millbrook, N. Y., recently incorporated with a capital of $500,000, will establish a plant for the manufacture of fire-alarm devices, etc. G. F. Johnson, New York, N. Y., is one of the directors.

The Mercedes Motor Car Co. is planning to erect a factory, at Niagara Falls, N. Y.

The George F. Shevlin Mfg. Co. has been incorporated, with a capital stock of $600,000, and will build and operate a foundry, at Saratoga Springs, N. Y. The directors are George F. Shevlin and C. R. Kilmer, Saratoga Springs, and T. Kerley, Ballston Spa, N. Y.

Case Bros. Cutlery Co. has completed plans for a new manufacturing plant, at Springville, N. Y., and construction will be commenced at once.

Deere & Co., purchasers of the plant of the Syracuse Chilled Plow Co., Syracuse, N. Y., have completed plans for the enlargement of the plant.

The Russ & Krekel Co., White Plains, N. Y., recently incorporated with a capital of $40,000, will build a plant for the manufacture of steam power heating and ventilating apparatus. E. T. Child, J. M. Scott and J. E. Jeffery, New York, N. Y., are the directors.

The Blériot Aëroplane Co. will erect a plant at Point Pleasant, N. J., for the manufacture of aëroplanes.

The Mack Bros. Auto Truck Co., Allentown, Penn., will expend about $250,000 for additions and improvements to its plant.

The roundhouse of the Lehigh Valley R.R., at Coxton, Penn., was damaged by fire, Apr. 27. Loss, $10,000. A. M. McGill, Sayre, Penn., is shop superintendent.

The Schlieper-Daae Engineering Co., Ferguson Building, Pittsburg, Penn., is preparing plans for a ten-mill tinplate plant, to be erected for the Pittsburg Sheet & Tinplate Co.

The Westinghouse Electric & Mfg. Co., Pittsburg, Penn., will erect a foundry in Trafford City, Penn.

Bids are asked as follows until 10 a.m., May 21, by the Paymaster-General, U. S. N., chief of the bureau of supplies and accounts, navy department, Washington, D. C., for naval supplies: Schedule 4517, Class 161, 3500 lb. rolled naval brass rod, round, ¾-in., for delivery at the navy yard, Brooklyn, N. Y.; Class 162, 1360 lb. brass, sheet, rolled, for delivery at the navy yard, Norfolk, Va.; Class 163, 4460 lb., copper tubing, seamless drawn, various sizes, for delivery at the same yard; Class 164, 1700 lb. brass hexagon nuts, semi-finished, chamfered and tapped, for delivery at the navy yard, Brooklyn, N. Y.; Schedule 4520, Class 181, one tandem steam road roller, five tons, for delivery at the navy yard, Charleston, S. C.; until 10 a.m., June 4, for delivering at the navy yard, Puget Sound, Wash., one ten-ton, three-motor electric jib crane, to have a capacity of 20,000 lb., extreme radius, 22½ ft.; effective radius, about 14 ft., to be operated by three-phase, 60-cycle, 220-volt, fully inclosed motors.

SOUTHERN STATES

The Emerson Engine Co., Alexandria, Va., is erecting an addition to its plant.

The Virginia Ry. & Power Co., Norfolk, Va., has awarded the contract to erect car barns, 40x100 ft., roundhouse, 100x100 ft., and office building.

The Pittsburgh Sheet & Tin Plate Co., Morgantown, W. Va., is erecting seven buildings for its plant. The main building will be 120x550 ft.; annealing plant, 60x200 ft.; tinning building, 60x400 ft.; galvanizing building, 50x150 ft.; planishing building, 80x120 ft.; pressing and shaping building, 80x80 ft., and office building, 40x50 ft. G. C. Sturgis is the president.

Brown Bros., Elkin, N. C., are considering the erection of a plant for the manufacture of machinery.

W. L. Peel will erect a garage, at Peachtree St. and Merritts Ave., Atlanta, Ga., to cost $50,000.

The Birmingham Tool & Implement Co., Birmingham, Ala., will erect a plant, at North Birmingham, to manufacture key presses.

The Tidewater Co., Birmingham, Ala., has purchased five acres at Ensley and will erect a car-repair shop.

The H. Hitt Lumber Co. will erect a planing mill, a coffin factory and woodworking plant, at Decatur, Ala.

Sidney Long contemplates erecting a large canning factory in Greenville, Ala.

C. B. Atkin, Knoxville, Tenn., will erect a garage.

MIDDLE WEST

A garage will be built by the City Auto Livery Co., Cleveland, Ohio.

The Sanitary Tool & Specialty Co., Cleveland, Ohio, organized with $100,000, to make metal specialties, will buy some light machine-shop tools. H. Wible is the manager.

The Park Drop Forge Co., Cleveland, Ohio, has had plans prepared for a new machine shop and office building, 65x120 ft.

The Cincinnati Gear Co., Ninth St. and Broadway, Cincinnati, Ohio, will erect a factory building. G. W. Drach is the architect.

The Modern Foundry Co., Oakley, Cincinnati, Ohio, will soon let contract for a one-story, brick and steel addition, 36x190 ft., to its plant.

A $15,000 garage is to be constructed on Columbia Road, Cincinnati, Ohio, by E. Palmer Bernheim.

The Hess Spring & Axle Co., Cincinnati, Ohio, has let the contract for an additional extension to its plant at Carthage, Ohio.

Fire destroyed the shops and oil house of the Pennsylvania R.R. Co., at Crestline, Ohio.

The Defiance Machine Works, Defiance, Ohio, is building an erecting shop, 77x132 ft., and a shop, 97x115 ft., to be used for cleaning castings to contain the shafting, plate, grinding and blacksmith departments.

The Galion Metallic Vault Co., Galion, Ohio, will erect a three-story addition, 50x80 ft.

The H. V. Dockroy Brass & Iron Co., Zanesville, Ohio, will build a new plant.

The Trumbull Steel Co., Warren, Ohio, is erecting a tinplate mill.

The Superior Iron & Mfg. Co., Wausen, Ohio, will enlarge its plant.

W. H. B. Ward, Jonathan Warner and H. B. Hardesty have organized with $1,000,000 capital to erect a sheet steel mill to cost about $500,000, at Warren, Ohio.

The Automatic Sprinkler Co. of America, with plants at Akron, Philadelphia and Syracuse, will locate in Youngstown, Ohio. Work on the buildings at Poland Ave. and John St., will be started at once.

The National Supply & Construction Co., Ellwood City, Penn., will erect a plant at Youngstown, Ohio. A. E. Frey is the president.

The Bocklett King Co., manufacturer of plumbers' materials, West Main St., Xenia, Ohio, will construct an addition, 60x200 ft., to its plant.

The Brazil Machine & Foundry Co., Brazil, Ind., is erecting an addition to its plant.

The Marvel Carburetor Co., 2230 Almont St., Indianapolis, Ind., will erect an addition to its plant.

The J. I. Case Threshing Machine Co., Indianapolis, Ind., is constructing a six-story building at Senate Ave. and St. Clair St., at an estimated cost of about $100,000.

The George Cutter Co., manufacturer of electric supplies, will erect a one-story brick building, 80x100 ft., at South Bend, Ind.

The Baltimore & Ohio R.R. has awarded the contract for the erection of two additions to its machine shop at Washington, Ind.

The Battle Creek Oven Rack Co., Battle Creek, Mich., reorganized as the United Wire & Steel Co., will erect two new manufacturing plants, one 35x120 ft., and the other 30x30 ft. The company manufactures a line of oven racks and owns a patented process of electric welding.

The Robinson Automatic Machine Co., Detroit, Mich., is building a one-story brick factory to cost $1200.

The Michigan Electric Welding Co., Detroit, Mich., which recently purchased the Detroit Electric Welding Co., has consolidated and moved to the plant occupied by the Universal Radiator Co. The plant consists of one machine shop, an electric-welding department and gas-welding department. The company contemplates the erection of a three-story reinforced-concrete building.

The Safety Furnace Pipe Co., manufacturer of furnaces, Detroit, Mich., is building an addition to its factory.

The National Twist Drill Co., Detroit, Mich., is building an addition to its factory.

The storage and testing shed of the Williams Machinery Co., 186 Bellevue Ave., Detroit, Mich., was damaged by fire, Apr. 27. Loss, $5000, covered by insurance.

The City Garage, Holland, Mich., is to be enlarged.

A one-story, 75x125-ft. addition to the plant of the Sparks-Withington Co., manufacturer of automobile accessories, Jackson, Mich., is in course of construction. The new building, which is of the saw-tooth design, will contain annealing ovens and the testing department.

Claire Allen, 24 Dwight Bldg., Jackson, Mich., is preparing plans for a one-story factory, 150x150 and 30x60 ft., for the Hastings Motor Shaft Co., Hastings, Mich. It will be located in Jackson. The estimated cost is $35,000.

The Saranac Machine Co., St. Joseph, Mich., will erect a new building at Benton Harbor, Mich., where it will remove its plant.

The Chippewa Engine Works, Sault Ste. Marie, Mich., will erect a new plant.

The Cant Hook Factory, owned by C. A. and M. E. Wellman, South Boardman, Mich., was totally destroyed by an explosion. The plant will be rebuilt immediately. Cost, $40,000.

Ernest L. Jones, Vermontville, Mich., contemplates building a garage adjoining his blacksmith shop. The new building, which is to be of frame construction with a cement floor, will be used for all kinds of automobile repair work.

WEST OF THE MISSISSIPPI

A garage and machine shop, 70x100 ft., is being constructed for Peter Johnson & Son, Decorah, Iowa.

The general contract for the construction of a steel and reinforced-concrete garage for Kopac Bros., Schuyler, Neb., has been awarded. The estimated cost is $25,000.

Jukes & Hutchings, El Paso, Tex., have awarded the contract for the construction of a fireproof garage and salesroom.

WESTERN STATES

The Motor Distributing Co., representing the Lozier car in Seattle, Wash., contemplates spending about $80,000 for the the Lozier in Seattle. A site, 70x130 ft. at Broadway and Pike St., has been purchased and work has been started on a $30,000 garage and salesroom. Shops and a service system are to be included in the new building.

James Finer, Portland, Ore., will erect a commercial garage and machine shop at East Twenty-seventh and Burnside Sts.

C. E. Holzer, Portland, Ore., has acquired a site, 100x100 ft., at East Third and Everett Sts., and will build a plant for the manufacture of sheet metal.

J. W. Cowan is erecting a garage and repair shop, at Yoncalla, Ore.

The Los Angeles Ice & Cold Storage Co., Los Angeles, Calif., will erect a two-story brick machine-shop addition to its plant on Fourth St.

The Baker Iron Works, Los Angeles, Calif., will erect a foundry on Castelar St.

The Rivers Bros. Co., Los Angeles, Calif., will erect a modern commercial garage and machine shop on Santa Fé Ave., Los Angeles.

In connection with the new mechanical building to be erected by the city of Los Angeles, Calif., a machine shop and municipal garage for city work will be installed. The supply committee of the city council is in charge of the work.

The Carbon Iron Co., Los Angeles, Calif., will erect a plant at Dominguez Junction, near Los Angeles, for the manufacture of pig iron from steel scrap and old railroad steel. The estimated cost is $100,000. M. K. Thompson represents the company

Frank Boyle will establish a factory in Oroville, Calif., for the manufacture of pumps.

St. George Holden, San Francisco, Calif., will erect a commercial garage and machine shop on North Post St., San Francisco. Estimated cost, $10,000.

CANADA

The Thetford Metal Works, Thetford Mines, Que., will build a large addition to its plant.

Campbell Bros., Ottawa, Que., will build a steel and iron plant on Carlin Ave.

The St. Marys Mfg. Co., St. Marys, Ohio, will build a factory at Chatham, Ont., for the manufacture of gas and gasoline engines.

The McDonald Thresher Co., Stratford, Ont., will double the capacity of its plant.

The Gurney Foundry Co., Toronto, Ont., will build a large addition to its plant.

The Reo Motor Car Co. is preparing to enlarge its plant at St. Catharines, Ont.

The Baker Motor Vehicle Co., Cleveland, Ohio, will build a branch factory at Walkerville, Ont.

The Kerr Engine Works, Walkerville, Ont., will build a large addition to its factory.

The Dominion Safe Works, Vancouver, B. C., are contemplatng the construction of a plant. G. J. Goehler is superintendent.

NEW INCORPORATIONS

METAL WORKING

The following companies have been incorporated to manufacture:

The A. N. Ames Knitting Co., Augusta, Maine; knitting machinery. Capital, $150,000. E. M. Leavitt, Augusta, is president.

The Charles E. Hall & Sons Co., Malden, Mass.; automobiles. Capital, $5000. Incorporators, Robert J. Cram, Atherton N. Hunt and Frank M. Sawtell.

The New Haven Aero Co., New Haven, Conn.; aëroplanes. Capital, $10,000. Incorporators: James E. Wheeler, Peter J. McNerney and Roscoe P. Brown.

The Wischerth Mfg. Co., Brooklyn, N. Y.; machinery. Capital, $25,000. Incorporators: F. Wischerth, G. Wischert and G. J. Brueckner, Borough of Queens.

The Camillus Cutlery Co., Camillus, N. Y. Capital, $220,000. Incorporators: W. H. Jeffers, L. S. Ehrich, Jr., and J. Scholer, New York, N. Y.

The Fireproof Ironing Board Co., Manhattan, N. Y.; electrical apparatus. Capital, $10,000. Incorporators: Max Greenberg, 773 Willoughby Ave., Louis Frunkes, 507 Penn. Ave., and Harold A. Leschinsky, 3 Moore St., all of Brooklyn, N. Y.

The Roeser-Sommer Co., Manhattan, N. Y.; lighting devices. Capital, $20,000. Incorporators: Christian Roeser, Edward C. Sommer, 75 West Fify-eighth St., and Charles R. Sommer, 3 Rutherford Pl.

The Dual Wheel Co., Manhattan, N. Y.; wheels and other parts of motor trucks. Capital, $300,000. Incorporators: Frederic B. Cochran, 71 Broadway; Alexander Dow, 104 West Forty-second St., and Cuthbert W. Jewell, 2 Rector St., New York, N. Y.

The Kenyon-Stearns Organization, Inc., Manhattan, N. Y.; office machinery and appliances. Capital, $100,000. Incorporators: H. L. Goodwin, G. Middleton and E. E. Thorpe, Manhattan.

The Postage Stamp Sales Co., Manhattan, N. Y.; postage-stamp vending machines. Capital, $150,00. Incorporators: G. W. Everitt, M. C. Duane and H. Roth, New York, N. Y.

The American Materials Co., Manhattan, N. Y.; railroad equipment. Capital, $250,000. Incorporators: F. H. Greene, S. G. Allen and J. S. Coffin, New York, N. Y.

F. T. Ellithorpe & Sons, Inc., Manhattan, N. Y.; elevators. Capital, $250,000. Incorporators, F. T. Ellithorpe, New York, N. Y.; T. R. Edwards, Brooklyn, and A. Gronich, New York.

The El Arco Radiator Co., Manhattan, N. Y.; automobiles, engines and motors. Capital, $10,000. Incorporators, C. Philip Coleman, Vernon Monroe, Englewood, N. J., and Raleigh C. Geldersleeve, 27 West Thirtieth St., New York, N. Y.

The Isotta Fraschini Motors Co., Manhattan, N. Y.; automobiles, motors and engines. Capital, $25,000. Incorporators, G. M. Hecksher, Huntington; G. N. Thurber, East Orange, N. J., and C. B. Jaqua, Paterson, N. J.

The Magneto-Dynamotor Co., Manhattan, N. Y.; machinery. Capital, $100,000. Incorporators, G. L. Henry, F. B. Moody and B. T. Moody, New York, N. Y.

The Monroe Calculating Machine Co., Manhattan, N. Y.; calculating machines. Capital, $100,000. Incorporators: J. R. Monroe, East Orange, N. J.; G. Tumpson, F. A. Wagner, New York, N. Y.

Fyro Extinguisher Co., Syracuse, N. Y.; fire extinguishers. Capital, $40,000. Incorporators: W. Allen, E. D. Allen and W. H. Tibbals, Syracuse.

The Union Specialty Co., Paterson, N. J.; plumbing and sanitary fixtures and supplies. Capital, $100,000. Incorporators: R. H. Cunningham, G. A. Hunziker and F. H. Sykes.

The Ceylon Filler Co., of New Jersey, Camden, N. J.; automobiles, carriages and wagons. Capital, $3000. Incorporators, Howard L. Merrick, J. A. Kinney and William Williams.

The Keystone National Electric Co., Hoboken, N. J.; incandescent lamps, electrical apparatus and machinery. Capital, $600,000. Incorporators, D. F. Plahn, Newark St., Hoboken; Charles W. Shaffer, 203 West Ninety-first St.; Robert K. Mickey, 136 Liberty St., New York, N. Y.

The Electric Ore Separator Co., Harrisburg, Penn.; separating machines. Capital, $50,000. Incorporators, M. W. Jacobs, Harrisburg; Joseph Wheaterbury, New Cumberland, Penn.

The Hillen Mfg. Co., Louisville, Ky.; plumbing supplies. Capital, $20,000. Incorporators, George P. Hillen, Oscar C. Hillen and William F. Hillen.

The Akron Cutting Car Co., Akron, Ohio; garage. Capital, $5000. Incorporators: C. W. Bair, H. F. Schoner and S. O. Marsh.

The Canton Metal Ceiling Co., Canton, Ohio; metal products. Capital, $200,000. Incorporators: Clarence A. Weirich, Homer V. Briggle and Elmer E. Schweyer.

The Angell Nail & Chaplet Co., Cleveland, Ohio; nails, chaplets, rivets, tacks and springs. Capital, $24,000. Incorporators: George W. Angell, J. Arthur Hambleton and Charles F. Homeier.

The Unigraph Co., Cleveland, Ohio; printing machines, office supplies and devices. Capital, $25,000. Incorporators: H. H. Weedon, S. A. Robinson and G. H. Billman.

The Columbia Metal Stamping Co., Cleveland, Ohio; metal dies. Capital, $25,000. Incorporators: Fred C. Koch, James E. Ertel and Harry C. Gahn.

The National Floor Planing Co., Dayton, Ohio; floor planing machines. Capital, $24,000. Incorporators, H. L. Young, Louis B. Reohm and Grant King.

The Steel Post Co., Kent, Ohio; steel posts and farming instruments. Capital, $100,000. Incorporators: Joseph H. Raub, Ranson R. Spoor and Clyde C. Smith.

The Dragon Mfg. Co., Marietta, Ohio; valve cups, hardware and oil- and gas-well fittings. Capital, $10,000. Incorporators: J. S. H. Forner, L. F. Forner and Howard T. Turner.

The Indiana Electric Appliance Co., Fort Wayne, Ind. Capital, $25,000. Incorporators: W. L. Moellering and C. E. Prange.

The Jackson Boulevard Garage Co., Chicago, Ill.; garage. Capital, $15,000. Incorporators: J. V. Pierce, W. J. Pierce and Barnard Miller.

The Cravens Co., Chicago, Ill.; electrical devices. Capital, $5000. Incorporators, George W. Cravens, Ralph Bicard and William F. Freudenreich.

The Central Plow Steel Co., Chicago, Ill., metals. Capital, $2500. Incorporators, S. S. Jonas, John R. Pruyn and L. C. Cooper.

The Smith-Bivert Co., Chicago, Ill.; machinery. Capital, $2500. Incorporators: P. Rosenberg, M. Hennessy and William B. Ward.

The Power Saving Co., Chicago, Ill.; machinery and mechanical devices. Capital, $2500. Incorporators: L. Hansen Dahl, Preston W. Barclay and Albert J. Geis.

The Perfect Vacuum Can Co., Chicago, Ill.; cans and machinery. Capital, $10,000. Incorporators, Charles O. Randall, William E. Helender and Lester L. Falk.

The Nestor Johnson Mfg. Co., Chicago, Ill.; skates. Capital, $10,000. Incorporators, Nestor Johnson, Annie Johnson and Julian T. Fitzgerald.

The Hollywood Garage Co., Chicago, Ill.; garage and repair shop. Capital, $5000. Incorporators: Clarke M. Cavenee, W. F. Olds and B. A. Shuster.

The Illinois Motor Patents Co., Chicago, Ill., automobiles and automobile parts. Capital, $5000. Incorporators, William D. Kirk, Edward C. Marsh and George E. Daniels.

The Union Electric Engineering Co., Chicago, Ill.; electric motors and machinery. Capital $2500. Incorporators, Ambrose A. Worsley, Walter P. Stuart and Hugo Krause.

The Pilot Automobile Co., Chicago, Ill.; automobiles and accessories. Capital, $5400. Incorporators, W. A. Dugane, C. H. Rodenbach and A. E. Pattison.

The Key Calk Horseshoe Mfg. Co., Green Bay, Wis. Capital, $40,000. Incorporators: G. Kuestermann, J. W. Bodiley and W. L. Evans.

L. C. Wood & Co., Alden, Iowa; excavating machinery. Capital, $25,000. Incorporators, L. C. Wood, G. W. Gardner and R. J. Darrah.

The Texas Electric Construction Co., Galveston, Tex.; electric signs. Capital, $1000. Incorporators, B. G. Hamlett, Fred A. Wolters and W. D. Baggett.

General Manufacturing

NEW ENGLAND STATES

The Saco Valley Canning Co. is considering the erection of a plant at Harmony, Maine.

Fire has destroyed the lighting plant at Island Falls, Maine.

The mill of the Raymond Lumber Co., at Raymond, Maine, owned by F. W. Plummer, E. A. Plummer and G. H. Hall, was destroyed by fire, Apr. 25. Loss, $8000.

Fire has destroyed the lumber plant of the Sherman Lumber Co., at Sherman Station, Maine.

The Fairbanks Lumber Mills, Unity, Me., were destroyed by fire, Apr. 26. Loss, $10,000.

The Holden-Leonard Mfg. Co., Bennington, Vt., manufacturer of woolen fabrics, has started work on the erection of an addition to its mill, 60x80 ft., one story.

The trustees of the Children's Hospital, Boston, Mass., will erect a new building, to be used as a laundry.

The Sprague, Breed & Brown Co., coal yards, Beverly, Mass., will add another boiler to their steam plant.

The Central Massachusetts Electric Co., Palmer, Mass., is reconstructing its power plant in Blanchard, Mass.

The American Thread Co., Holyoke, Mass., is planning to combine its five local plants in a larger plant at Canal and Bridge Sts.

J. S. Mason, Westboro, Mass., operating a plant for the manufacture of cotton, mercerized and silk ribbons, will erect a large mill.

James C. Doran & Sons, Providence, R. I., makers of jewelry, will add a five-story addition to their plant.

The American Graphophone Co., Bridgeport, Conn., will add an additional story to its roll mill, 113x63 ft., of brick, mill construction.

Warner Bros., manufacturers of corsets, Bridgeport, Conn., will award the contract for the construction of their proposed new plant at once. Noted Mar. 14

The American Paper Goods Co., Kensington, Conn., will add a new pumping station to its water-power plant.

The Wet Wash Laundry, Madison, Conn., is erecting a new laundry, one story, 25x40 ft., of wood and brick.

MIDDLE ATLANTIC STATES

The board of water commissioners, of Binghamton, N. Y., has voted to construct an addition to the filtration plant. Estimated cost, about $75,000.

Esenwein & Johnson, architects, Ellicott Square, Buffalo, N. Y., will supervise the reconstruction of the pumping station at Porter Ave., for the city of Buffalo, to replace the structure which collapsed last summer. The building will be of structural steel, stone, brick and concrete. Estimated cost, $350,000.

The Consumers' Biscuit & Mfg. Co., New York, N. Y., will erect a new plant, at Park and Waverly Aves., Brooklyn, N. Y.

The Roman Catholic Orphan Asylum, 564 Dodge St., Buffalo, N. Y., will erect a two-story brick boiler house, to cost $30,000.

The feed and grist mills of Farney & Steiner, at Croghan, N. Y., were destroyed by fire, May 1. Estimated loss, $200,000.

The Hoag Knitting Mill, Milton, N. Y., will move to Cold Spring, N. Y., and consolidate with the branch there.

The American Glove Co. has completed arrangements for the building of an additional story on its present plant, at Dunkirk, N. Y.

The Thatcher Mfg. Co., Elmira, N. Y., is having plans prepared for a one-story brick factory with a floor space of 56,000 sq.ft., for the manufacture of milk bottles and caps.

The plant of the Howard A. Pierce Electric Light Co., Hamburg, N. Y., has been purchased by Albert Dodge, Hamburg. He will erect an additional power house on Prospect Ave., and equip it for a new system of street lighting.

Work has started on the erection of a large power house in connection with the new factory to be built for Endicott, Johnson & Co., Lestershire, N. Y.

The building at 29-35 West Thirty-second St., New York, N. Y., was damaged by fire, Apr. 29. The building was occupied in part by the Brunswick-Balke-Collender Co., manufacturer of billiard supplies, D. Appleton & Co., publishers, Henry Holt & Co., publishers, F. J. Manne, furrier, and the Cambridge University Press. Loss, $500,000.

M. Welte & Son, manufacturers of piano players and organs, Freiburg, Germany, will erect a $60,000 factory, at Poughkeepsie, N. Y. A site has been acquired and work will start in May. Edwin Welte, the president, may be addressed at Poughkeepsie.

Bids are being received by F. A. Brockett, Curler Bldg., Rochester, N. Y., for the construction of a four-story factory and warehouse for the Clark Paper & Mfg. Co., at Greece, N. Y. It will be of brick and steel, 170x64 ft.

The Sterling Furniture Co., Salamanca, N. Y., has awarded a contract for the construction of a four-story and basement addition, 50x114 ft., to its factory.

The basket factory and wood-working plant of Eugene C. Cobb, Sherman, N. Y., was destroyed by fire, Apr. 25. Loss, $15,000, on the building and machinery.

The New Process Rawhide Co., Syracuse, N. Y., has begun the construction of a factory to cost $85,000, with equipment costing $45,000. The building will be four stories and basement, 186x66 ft. wide. It will be a fireproof reinforced-concrete and brick structure.

Charles Freihofer, Philadelphia, Penn., will erect a new bakery on the southwest corner of Twenty-sixth St. and Second Ave., Troy, N. Y., the cost to be about $50,000. The work will begin about May 6.

Charles H. Kavanaugh, Waterford, N. Y., is having plans prepared for a bleachery which he will erect on a site recently purchased and which has a frontage of 150 ft.

The Bridgeton Ry. Co., Bridgeton, N. J., will erect a one-story power house, 34x92 ft. The American Ry. Co., Witherspoon Building, Philadelphia, Penn., which controls the company, is receiving bids.

The Lambertville Pottery Co., Lambertville, N. J., has awarded the contract for constructing two additional buildings to its plant. One will be a four-story structure, 48x62 ft., and the other one story, 72x72 ft.

The Continental Leather Co., Newark, N. J., will build a five-story brick factory at 124 Warren St., to cost about $60,000.

The Martin Dennis Co., manufacturer of tanners' supplies, Newark, N. J., will erect a two-story factory, 65x125 ft., adjoining its present plant, on Summer Ave. Estimated cost, $26,000.

The Atlantic Product Co., Atlantic City, N. J., will install a garbage plant, 60x100. The contract has been awarded.

The Kensington Water Co., which supplies the towns of New Kensington, Parnassus and Arnold, Penn., has awarded a contract for a 3,000,000-gal. mechanical filter plant, designed by Chester & Fleming, hydraulic engineers, Pittsburg, Penn.

The Macbeth Evans Glass Co., Pittsburg, Penn., will erect a three-story brick factory, 48x120 ft., at Charleroi. The estimated cost is $15,000.

Ursinus College, Collegeville, Penn., will erect a power plant. Rev. A. E. Keigwin is president.

The Acme Wagon Co., Emigsville, Penn., is having plans prepared for a two-story, reinforced-concrete addition, 60x200 ft., to its factory. The estimated cost is $15,000. S. S. Smith & Co., Hartman Bldg., York, Penn., are architects and engineers.

The saturating plant of the H. F. Watson Co., on the bay front, near the foot of Myrtle St., Erie, Penn., was damaged by fire, Apr. 25.

The soap-manufacturing plant of Shucker & Shindel, Lebanon, Penn., was damaged by fire, Apr. 28. Loss, $2500.

The fertilizing plant of the American Agricultural Chemical Co., at Weccaco St. and the Delaware River, Philadelphia, Penn., was destroyed by fire, Apr. 24. Estimated loss, $25,000.

Henry Disston's Sons, manufacturers of saws, Tacony, Philadelphia, Penn., will erect a crucible house, 63x143 ft. Estimated cost, $25,000.

The Philadelphia Electric Co., Tenth and Chestnut Sts., Philadelphia, Penn., will erect a power house at Christian and Schuylkill Aves. The building will be of brick, four stories, 170x55 ft. H. J. T. Windrim, Commonwealth Building, Philadelphia, is the architect.

The five-story building at Third and Market Sts., Philadelphia, Penn., was damaged by fire, Apr. 29. The building was occupied in part by H. J. Ittelsen, manufacturer of canvas covers. Loss, $20,000.

Plans are under way by Evans, Warner & Bigger, architects, Witherspoon Building, Philadelphia, Penn., for a garage, laundry and power house, at Paoli, Penn., for S. B. Davis.

William F. Read & Sons Co. will make alterations to and increase the capacity of its power plant, at Iseminger and Jackson Sts., Philadelphia, Penn.

The contract has been awarded for the erection of a three-story brick and concrete factory addition for the Beaver Valley Pottery Co., Rochester, Penn.

The Illingsworth Resonate Timber Co., Continental Bldg., Baltimore, Md., is having preliminary plans prepared for a resonate wood preparing plant at Dorsey. J. Warren Illingsworth, 410 Continental Bldg., Baltimore, is president.

The Mount Vernon-Woodberry Cotton Duck Co., Continental Bldg., Baltimore, Md., have had plans prepared for a weave house to be erected at Hampden, Md.

The box factory of Gordon & Sons, 228 North Front St., Baltimore, Md., was damaged by fire, Apr. 26. Loss, $1000, partly covered by insurance.

SOUTHERN STATES

The Graham Mattress Co., Graham, Va., advise us that a new two-story factory, having a ground area of 15,000 sq.ft., will be erected in place of the one damaged by fire. The machinery required will include belts, pulleys, hangers, etc. O. A. Metcalf is president. Noted May 2.

The flour mill, at McGrady's Gap, near Saltville, Va., owned by McGrady, Lamie & Co., and leased by Thomas Sanders, was destroyed by fire, Apr. 26. Loss, $8000; insurance, $5000.

The Appalachian Furniture Co., Bluefield, W. Va., recently incorporated, has had plans prepared for a three-story brick furniture factory.

The Central Veneer Co., Huntington, W. Va., will make improvements at its veneer factory, including installation of cutter and automatic dryer, and a two-story addition, 40x60 ft.

The Bladenboro Cotton Mills has awarded the contract to J. W. Robertson, Raleigh, N. C., to erect a 103x419-ft. brick building, costing $35,000 to $40,000, at Bladenboro, N. C.

The North Carolina Gas Co., Raleigh, N. C., has purchased one acre on which to build gas plant. Estimated cost, $40,000.

Fire destroyed the tobacco factory of J. P. Taylor & Bros., at Winston-Salem, N. C.

The Independent Ice Co., Wilmington, N. C., is having plans prepared for a three-story and basement, reinforced-concrete cold-storage plant and warehouse. Joseph F. Leitner, Wilmington, is the architect.

The Polar Ice Co., Anniston, Ala., is erecting an ice plant at a cost of about $65,000.

The chair and box manufacturing department of the Industrial Lumber Co., at Augusta, Ga., was damaged by fire, Apr. 28.

Reaves & Doughty, Greeneville, Tenn., will erect a laundry, at La Grange, Ga., to be operated by electricity, to cost $12,000.

The Southern Calcium Phosphate Co., capital, $2,500,000, will erect plants at Birmingham, Selma, Montgomery and Mobile, in Alabama, and Hillsdale, Macon and Atlanta, Ga., and at Charleston, S. C., the first at Hillsdale, Ga., to manufacture fertilizer without sulphuric acid under patent of George R. Fishburne.

The American Oak Tanning Co., New Decatur, Ala., will rebuild its tannery.

Sidney Long is organizing a company to construct a canning factory to be built at Greenville, Alta.

Gulf City Milling Co., Mobile, Ala., is contemplating an addition to its mill at Kelly and Tennessee Sts.

D. E. Dennis and William Conner, Hattiesburg, Miss., have leased a site near the freight office of the Mississippi Central R.R. Co. and will erect a canning factory.

J. J. Spragins & Son, Jackson, Miss., have purchased 15 acres, on which to erect a hardwood plant.

The Stonewall Cotton Mills are erecting dyeing and finishing plants at Stonewall, Miss. T. L. Wainwright is the president.

The Sumner Gin Co.'s cotton gin, Sumner, Miss., was damaged at a loss of $15,000.

The Union Petroleum Co., Philadelphia, Penn., has purchased 12 acres on which to build a plant, at New Orleans, La. M. F. Ryan is local manager.

The Magic Food Co., Chattanooga, Tenn., will erect an addition on King St. F. C. Mansfield is the president.

The Welch Stave & Heading Co., Monterey, Tenn., will build stave and heading plant, at Grapevine, Tenn.

The plant of the Memphis Coffin Co., Memphis, Tenn., was damaged by fire, Apr. 30. Loss, $1000.

D. R. Hutzell, Knoxville, Tenn., will immediately erect a large steam laundry.

Smith & Harrison, Knoxville, Tenn., are equipping a clothing factory. The building, 50x110 ft., which will be four stories high, is being erected.

Gale P. Kyle, who has been awarded a franchise to operate a water system, at Rogersville, Tenn., has begun the construction of the plant.

The Farmers' Union Milling Co.'s flour mill, Fulton, Ky., was damaged at a loss of $20,000.

The flour mill of Charles Noonan, Fulton, Ky., was burned, Apr. 23, at a loss of about $20,000.

The Harris Limestone Co., Glasgow, Ky., contemplates the erection of a new plant and will be in the market for rock-crushing machinery.

A broom factory is to be established in Georgetown, Ky., by William Daugherty.

Henry Humkey, Lebanon, Ky., is building a carriage factory. Machinery will be needed.

A flour mill will be built by the R. M. K. Flour Co., which was incorporated at Livingston, Ky., with $12,000 capital stock, by John H. Walton and others.

J. J. Cozatt, Parkesville, Ky., is erecting a flour mill and elevator to cost about $20,000.

The Fooks Lumber Co., Paducah, Ky., is contemplating making improvements to its planing mill.

C. F. Rood, Winchester, Ky., will build a box factory.

MIDDLE WEST

The H. C. Davis Mfg. Co., Cleveland, Ohio, contemplates the erection of an automobile-tire factory at Alliance, Ohio, for which plans are now being prepared.

The B. F. Goodrich Co., maker of automobile tires, Akron, Ohio, contemplates erecting a fabric mill.

The Bucyrus Woolen Mills Co., Bucyrus, Ohio, is erecting a building 40x60 ft.

The Columbia Chemical Co., Barberton, Ohio, will build additions to its plant.

Power-plant equipment will be bought by the Nasker Ice Cream Mfg. Co., Canton, Ohio.

The Little River Lumber Co., Canton, Ohio, will buy some wood-working machinery for planing mill. H. S. Moses is the president.

The Lincoln Electric Co., Cleveland, Ohio, has secured a permit for the erection of an addition to its station, at 3744 Kelley Ave.

The Ideal Paper Box Co., Cleveland, Ohio, manufacturer of paper boxes, is erecting a new $40,000 factory.

The Phoenix Ice Machine Co., Cleveland, Ohio, has awarded the contract for the erection of a two-story machine shop.

The lumber yard and cooper shop of the Standard Oil Co., Cleveland, Ohio, was destroyed by fire, Apr. 28. Loss, $100,000.

The Regal Belting Co., Cincinnati, Ohio, will erect a $25,000 factory building, at 2520 Spring Grove Ave.

Organization of the Columbus Cereal Co., Columbus, Ohio, has been completed with J. F. Koontz, president; Harry Lamb, vice-president; J. Bowen, secretary and treasurer, and Charles Brook, general manager. The new company is now equipping a plant at 286 North Third St.

The Sanitary Earthenware Pottery Co., Trenton, N. J., has established a branch plant at Columbus, Ohio.

The Air Line Mfg. Co., who purchased the patents and tin working machines of the Forshee Mfg. Co., Dayton, Ohio, has moved its plant to Lancaster, Ohio.

The L. W. Keyes Cigar Box Co., Dayton, Ohio, will need some light woodworking machinery for a new cigar-box factory. L. W. Keyes is the manager.

The Licking Laundry Co., Newark, Ohio, will begin work on the erection of a large addition to its plant, in Jefferson St.

The Oxford Milling Co., Oxford, Ohio, will build a three-story frame iron-covered building, 60x72 ft., to replace the one recently destroyed by fire. George Nehr is the architect. Noted May 2.

The Steubenville Broom Co., Steubenville, Ohio, contemplates buying new broom-making machinery.

The Stine Pottery Co., White Cottage, Ohio, has started the erection of a new plant, to take the place of the one recently destroyed by fire.

The Coca-Cola Bottling Co., Youngstown, Ohio, has doubled its capital and will add to its power-plant equipment.

George W. Adams, Bryant, Ind., is having plans prepared and will soon ask bids for the construction of a large grain elevator.

The American Furniture Co., Batesville, Ind., is having plans prepared and will soon receive bids for the erection of a four-story factory, of brick.

An addition to the Wayne Knitting Mills is being erected at Fort Wayne, Ind.

The Wilson Bros. Shirt Co., South Bend, Ind., will erect a three-story brick factory, 60x150 ft., at 1008 West Sample St.

The board of public works, Benton Harbor, Mich., will improve the equipment of the municipal lighting plant.

The Diamond Mfg. Co., Detroit, Mich., will build a two-story reinforced-concrete factory at 261 Artillery St., to cost $72,000.

The plant of the Detroit Barrel Co., 1234 Michigan Ave., Detroit, Mich., was damaged by fire, Apr. 27. Loss, $5000.

The Albert & Pudrith Co., roofers, Detroit, Mich., are building a large new factory.

The Schmid Chemical Co., Wildwood Ave., Jackson, Mich., is having plans prepared for a three-story and basement factory. The cost will be about $35,000. Claire Allen, 24 Dwight Bldg., Jackson, is the architect.

Plans are being prepared and bids will soon be asked for the construction of a three-story and basement factory, 60x110 ft., for S. H. Camp, 259 West Main St., Jackson, Mich. The estimated cost is $25,000. L. H. Field, Jr., is the architect.

The Grand Rapids Molding Co., Grand Rapids, Mich., will erect a one-story cement factory to cost $2500.

The Petoskey Block & Mfg. Co., Petoskey, Mich., will rebuild its plant recently destroyed by fire.

The Saginaw Sandstone Brick Co., Saginaw, Mich., is making extensive improvements to its plant.

P. W. Prentice, Bay City, Mich., will establish a plant at West Branch, Mich., for the manufacture of potash.

The Stephens Stand-up Scrubber Co. will erect a new factory at Aurora, Ill.

The M. Reichardt Co., Chicago, Ill., will erect a piano factory at Ludington, Mich.

The J. P. Smith Co. is erecting a shoe factory at Sangamon and Pratt Sts., Chicago, Ill.

W. A. Busse will build a two-story brick factory, at 2700 West Lake St., Chicago, Ill., to manufacture chair bottoms. New machinery will be required.

The Mutual Ice Mfg. Co., Chicago, Ill., will build a one-story brick factory, at 1101 South Kedzie Ave., and will equip it with machinery for the manufacture of artificial ice.

The Burlington Blanket Co., Burlington, Wis., advises us that it will immediately rebuild its plant recently destroyed by fire. Noted Apr. 25.

The Fond du Lac Church Furniture Co., Janesville, Wis., will erect a large addition to its plant.

The Federal Rubber Co., Milwaukee, Wis., will enlarge its factory by a six-story addition, 100x400 ft. Byron C. Dowse is the president.

The Jersild Knitting Co., Neenah, Wis., will erect a new fireproof factory.

WEST OF THE MISSISSIPPI

George Hormel & Co., 16 East Third St., Austin, Minn., is erecting a cold-storage plant, at East Sixth and Pine Sts., at a cost of about $35,000. It will be of reinforced concrete and brick, 50x83 ft.

Bids were received by B. F. Carll, secretary of the Farmers' Elevator Co.,

Lansing, Minn., May 7, for the construction of a grain elevator.

Plans are being prepared for a water-works plant, at Bowdle, S. D. Easton & Wells, Aberdeen, S. D., are the engineers. The estimated cost is $15,000.

The contract has been awarded for the construction of a water-works system at Williston, N. D. The estimated cost is $10,000.

The plant of the Bakersfield Milling Co., at Bakersfield, Mo., was destroyed by fire, Apr. 24.

The factory of the Reliable Button Co., Canton, Mo., was destroyed by fire, Apr. 23. Loss, $18,000.

The mop factory of the Burgett Mfg. Co., Nineteenth St. and Grove Ave., Kansas City, Mo., was destroyed by fire, Apr. 24. Loss, $3700.

The Dorris Motor Co., St. Louis, Mo., is contemplating the erection of a power plant. The estimated cost is $7200.

The Cascade Milling & Elevator Co., Cascade, Mont., has awarded the contract for the construction of additions to its flour mill.

The ice factory and bottling works of the Big Spring Ice & Mfg. Co., Big Spring, Tex., were destroyed by fire, Apr. 27. Loss, $75,000; insurance, $28,000.

Hans & Sons, Cairo, Ill., and Sherman, Tex., will establish a large plant, at Houston, Tex., for the manufacture of shovel handles.

The city of New Braunfels, Tex., will receive bids until May 22 for constructing and improving the water-works and lighting systems. W. K. Palmer Co., Dwight Building, Kansas City, Mo., is the engineer.

The city of Pecos, Tex., will soon begin the installation of a municipal water system, estimated to cost $90,000.

George L. Caldwell will erect a cotton gin, at Robstown, Tex., at a cost of $10,000.

V. B. Colley, Smiley, Tex., will install an ice factory and an electric-light plant, at Stockdale, Tex.

The Somerville Ice Co., Somerville, Tex., will install additional machinery in its ice factory.

The International & Great Northern R.R. Co. has announced that a cold-storage plant for fruits and vegetables will be constructed, at San Antonio, Tex. It will be a five-story building, 148x80 ft., and will have a capacity of 500,000 cu.ft.

Z. T. Norwood, Wildorado, Tex., is preparing to install a factory, at Plainview, Tex., for the manufacture of tile, which will be used for subirrigation.

Bids will be received until May 14 for furnishing materials and machinery for the construction of water-works and electric-light plant extensions, at Wagoner, Okla. The estimated cost is $40,000. The Benham Engineering Co., Oklahoma City, Okla., is engineer.

Plans have been approved by the Board of Trustees, Perkins, Okla., for the installation of a water-works system to cost about $25,000. The Benham Engineering Co., Oklahoma City, Okla., is the engineer.

The town of Johnstown, Colo., is contemplating the installation of a water-works system, to cost about $20,000.

WESTERN STATES

The Robinson Fisheries Co., Anacortes, Wash., has started the erection of a fish-curing plant at Anacortes. The cost is $25,000. W. F. Robinson is president.

The Western Feed Co., Bellingham, Wash., will erect an alfalfa-meal plant, at Grant and Elk Sts., to cost about $12,000.

The city of Index, Wash., will soon vote bonds for the installation of a municipal water system.

J. Rowell, Montesano, Wash., is contemplating the erection of a fish-canning plant.

The Tyler Millinery Co., Spokane, Wash., will enlarge its plant and install new machinery. F. M. Tyler is president.

Harvey W. Bower, Denver, Colo., has acquired a site at Spokane, Wash., and will erect a refrigerator-manufacturing plant.

The Eagle Macaroni Mfg. Co., 2705 Pacific Ave., Tacoma, Wash., will build a large addition to its plant.

The Palmer Liquid Coffee Co., Milwaukee, Wis., is planning the erection of a plant for the manufacture of its finished product at Tacoma, Wash.

The Bay City Land Co., Bay City, Ore., is planning to install a complete new water system.

James C. Good Packing Co., Maegly Station, Ore., will erect a packing plant, to cost about $500,000, at Maegly Station, on the Peninsula, near Portland.

The city of Nyssa, Ore., will soon vote bonds for the installation of a water system.

The Standard Brick & Tile Co., Colton, Calif., recently incorporated with a capital of $100,000, will erect a plant. Charles A. Rolfe, Redlands, Calif., is president.

Charles C. Lord, 21 Pine Ave., Long Beach, Calif., is planning the construction of a factory to make goods and shell jewelry. It will cost about $10,000.

The Citrus Farms Co., Pleasant Valley, Calif., is planning a large irrigation project, involving the erection of two pumping plants. T. B. Leddy is general manager.

The Pacific American Fisheries Co., Seattle, Wash., will erect a salmon-canning plant at Port Allen, Alaska.

The White Star Canning Co., San Pedro, Calif., will build a two-story factory, 60x100 ft., on Crescent Wharf. The estimated cost is $75,000.

The Sacramento Clay Produce Co., Sacramento, Calif., which has taken over the Silica Brick Co., will spend about $20,000 in the completion of the plant in North Sacramento. B. F. Walton, of Yuba City, Calif., is president.

The Standard Carbon Products Co., San Francisco, Calif., will erect a plant, at Richmond, Calif., in the tract known as Wall's Second Addition. The estimated cost is $50,000.

CANADA

The Brampton Pulp & Lumber Co., Angus, Que., will build a large pulp mill.

W. R. Leach, Mooretown, Ont., will equip a $50,000 salt plant, at Courtright, Ont.

The city of Fergus, Ont., will install a water-works system.

Robinson Bros.' Cork Factory, Port Colborne, Ont., was completely destroyed by fire. Will be rebuilt at once.

The Smith Mfg. Co., Toronto, Ont., makers of woolen and cotton goods, will build a three-story brick factory, at Front and Princess Sts., Toronto. The estimated cost is $25,000.

The Forster Armstrong Piano Co. will erect a three-story factory, at Berlin, Ont. S. Nordheimer, Toronto, Ont., is president.

The National Drug & Chemical Co., of Canada, will erect a plant, at Beverley and Phoebe Sts., Toronto, Ont., at a cost of about $200,000. It will be of reinforced concrete.

The Diamond Glass Co., Wallaceburg, Ont., will erect a branch factory, at Medicine Hat, Alta. The estimated cost is $100,000.

The planing mills and the sash and door factory of the Canadian Puget Sound Lumber Mills, Rock Bay, Victoria, B. C., were destroyed by fire, Apr. 26. Loss, $100,000, covered by insurance.

NEW INCORPORATIONS

GENERAL MANUFACTURING

The following companies have been incorporated to manufacture:

The Pneumatic Vest Mfg. Co., Kittery, Maine; pneumatic vests. Capital, $100,000. Incorporators: G. E. Smart, G. E. Burnham.

The Sewell Cushion Wheel Co., Augusta, Maine; rubber and other tires. Capital, $300,000. I. S. Kearney is president.

The Missisquoi Pulp & Paper Co., Sheldon, Vt.; wood pulp and paper. Capital, $50,000. Incorporators: J. T. Shepley, West Groton, Mass.; J. P. Ramage, Northampton, Mass., and D. M. Shepley, Sheldon.

The Beaver Brook Paper Mills, Inc., Danbury, Conn.; paper. Capital, $100,000. Incorporators, Frederick M. Thompson, George A. Austin and John McCarthy.

The Seger-Prindle Mfg. Co., Friendship, N. Y.; mangle rollers and last blocks. Capital, $20,000. Incorporators: Horace G. Prindle, Little Genesee, N. Y.; Charles H. Seger, Genesee, and Frank R. Utter, Friendship.

The George T. Byers Co., Manhattan, N. Y.; fountain pens. Capital, $50,000. Incorporators: G. T. Byers, Nyack; J. W. Mitchell and A. H. Field, Brooklyn, N.Y.

Anderson & Prigge, Inc., Manhattan, N. Y.; stationery and loose-leaf binders. Capital, $60,000. Incorporators, E. M. Anderson, Jersey City, N. J.; H. Prigge, Palisade Park, N. J., and A. Anderson, Brooklyn, N. Y.

The Empire Show Case Co., Manhattan, N. Y.; showcases. Capital, $25,000. Incorporators, C. L. Weldon, L. Bartelstone, Brooklyn, and C. Newburger, Bronx, N. Y.

The Kaldenberg Trading Co., Manhattan, N. Y.; articles of ivory, staghorn and mother of pearl. Capital, $100,000. Incorporators: C. Newman, F. R. Kaldenberg, New York, N. Y., and F. O. Augustin, Jersey City, N. J.

Henry Guttman, Inc., Manhattan, N. Y.; furniture. Capital, $60,000. Incorporators: H. Guttman, H. Langer and J. Hartley, New York, N. Y.

The Charles E. Thompson Co., Manhattan, N. Y.; trunks, suit cases and bags. Capital, $100,000. Incorporators: C. E. Thompson, A. F. Flint, Boston, Mass., and H. C. Workman, New York, N. Y.

The John Somma Co., Manhattan, N. Y.; furniture. Capital, $150,000. Incorporators: J. P. Adams, Brooklyn; F. W. Walz and J. Davis, Manhattan.

The Oak Leather Co., Camden, N. J.; leather goods. Capital, $100,000. Incorporators: W. R. Carroll, G. H. Jacobs and G. Pancoast, Camden.

The Clifton Textile Co., Jersey City, N. J.; silk and other textile fabrics. Capital, $125,000. Incorporators: J. F. Curtin, H. O. Coughlan and H. T. Letts.

The New Jersey Glass Co., Salem, N. J.; glassware. Capital, $50,000. Incorporators: R. A. Craig, F. S. Newkirk and C. P. Wilson.

The Monarch Carbon Co., Charleston, W. Va.; lamp blacks and carbon blacks. Capital, $100,000. Incorporators: John W. Moore, J. D. Pribble and M. R. Matthews.

The Owens Eastern Bottle Co., Clarksburg, W. Va.; glassware. Capital, $1,000,000. Incorporators: E. B. Templeman, O. E. Swartz and R. M. Robinson.

The High Point & Decorative Co., High Point, N. C.; glass lamp shades, domes, and mirrors and frames. Capital, $10,000. Incorporators, A. K. Klemme, Charles Hortel and L. H. Davis.

The Mooney Belting Co., Cincinnati, Ohio; belting and packing. Capital, $25,000. Incorporators: T. E. Mooney, E. B. Mooney and G. T. Mooney.

The Buckeye Paper Co., Toledo, Ohio; paper and paper products. Capital, $20,000. Incorporators: George J. Norickel, Fred J. Libbing and Vincent J. Schlachter.

The Alerding-Ittenbach Co., Fort Wayne, Ind.; trunks and novelties. Capital, $15,000. Incorporators: Leo J. Alerding, L. J. Ittenbach and Lena Ittenbach.

The Goshen Concrete Tile Mfg. Co., Goshen, Ind. Capital, $15,000. Incorporators: A. D. Miller, O. F. Miller and Issac Bigler.

The United States Corrugated Fiber Box Co., Indianapolis, Ind.; shipping cases. Capital, $25,000. Incorporators: H. J. Lacy, R. J. Hauser and J. B. Fitch.

The Penn Novelty Works, Chicago, Ill.; textile goods. Capital, $2000. Incorporators: William L. Barteau, Thomas H. Riley and Ferree Cass.

The Peterson Clair Shoe Co., Chicago, Ill.; footwear. Capital, $5000. Incorporators: Edgar S. Peterson, Henry Gruetzmacher and Colonel N. Clair.

The Miller Novelty Furniture Co., Chicago, Ill.; furniture and novelties. Capital, $25,000. Incorporators: S. C. Miller, A. Sorensen and W. J. S. Hyde.

The National Building Material Co., Chicago, Ill.; clay products and building materials. Capital, $10,000. Incorporators: Frank F. Bour, Oscar C. Hunt and Charles B. Sears.

The Economy Gas Stove & Mfg. Co., Milwaukee, Wis. Capital, $20,000. Incorporators: C. S. Harris, T. E. Sellen and A. H. Chromasto.

The Fort Worth Marble & Granite Works, Fort Worth, Tex. Capital, $40,000. Incorporators, George A. Tumlin, Sidney M. Harrison and W. B. Harrison.

Business Items

Hill, Clarke & Co. has removed its Philadelphia office from 512 Arch St. to 1011 Chestnut St.

Bignall & Keeler Mfg. Co., Edwardsville, Ill., has appointed Manning, Maxwell & Moore sales agents for the Eastern States.

Owing to increased business the Allen Mfg. Co., Hartford, Conn., has moved into the shop until recently occupied by the Henry & Wright Mfg. Co.

The Union Gear & Machine Co., 85 Purchase St., Boston, Mass., has been formed and is now equipping a large plant at the above address for the purpose of manufacturing all kinds of gears and other machine-shop products. J. C. Horne, formerly with Boston Gear Works and the Fellows Gear Shaper Co., is the general manager.

The executive offices and New York show rooms of the H. W. Johns-Manville Co., manufacturers of asbestos, magnesia and electrical supplies, were moved on Apr. 20 to the new 12-story "H. W. Johns-Manville Building, Madison Ave. and 41st St., New York City, from their old quarters at 100 William St., where they have been located for the past 15 years.

Trade Catalogs

Brown Hoisting Machinery Co., Cleveland, Ohio. Pamphlet. Suspended coal bins. Illustrated, 36 pages, 6x9 in.

General Fire Extinguisher Co., Providence, R. I. Bulletin. Automatic sprinklers. Illustrated, 24 pages, 7¾x10 in.

General Electric Co., Schenectady, N. Y. Bulletin No. 4940. Commutating pole motors. Illustrated, 8 pages, 8x10½ in.

Oeking Co., 50 Church St., New York. Catalog. Punching and shearing machinery. Illustrated, 72 pages, 8x10½ in.

Woburn Gear Works, 32 Nashua St., Woburn, Mass. Catalog. Gears, sprockets, chains. Illustrated, 32 pages, 6x9 in.

The Moseley Lathe Co., Elgin, Ill. Catalog No. 11. Moseley lathe and attachments. Illustrated, 103 pages, 3½x6 in.

Industrial Instrument Co., Foxboro, Mass. Bulletin No. 61. Portable or hand tachometers. Illustrated, 8 pages, 8x11 in.

Universal Stamping Co., Buffalo, N. Y. Catalog. Safety devices for protecting tools, grinders, etc. Illustrated, 16 pages, 6x9 in.

W. S. Rockwell Co., 50 Church St., New York. Catalog No. 14. Annealing and hardening furnaces. Illustrated, 48 pages, 12x9 in.

American Drafting Furniture Co., Rochester, N. Y. Catalog, 17th edition. Drafting-room furniture. Illustrated, 68 pages, 6x9 in.

The W. P. Davis Machine Co., Rochester, N. Y. Booklet. Treatise on Keyseating and Keyways. Illustrated, 30 pages, 4x6¾ in.

General Electric Co., Schenectady, N. Y. Bulletin No. 4915. Type CVC direct-current motors of the commutating pole design. Illustrated, 20 pages, 8x10½ in. Bulletin No. 4933. Small polyphase motors, riveted frame construction. Illustrated, 12 pages, 8x10½ in.

Forthcoming Meetings

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association, Southern Supply and Machinery Dealers' Association. Triple convention, May 13-15, Norfolk, Va., Hotel Monticello. F. A. Mitchell, secretary, 309 Broadway, New York City.

Master Boiler Makers' Association. Sixth annual convention, Fort Pitt Hotel, Pittsburg, Penn., May 14-17. J. Rogers Flannery, secretary arrangements committee, Flannery Bolt Co., Pittsburg, Penn.

National Machine Tool Builders' Association. Semi-annual convention, May 16-17, Atlantic City, Hotel Chalfonte. men. Regular meeting third Thursday of each month. H. F. Sloan, secretary, 116 Nassau St., New York City.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June 12-14. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June 17-19. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

Society of Automobile Engineers, summer meeting, June 27-29, Hotel Ponchartrain, Detroit, Mich. C. F. Clarkson, secretary, 1451 Broadway, New York City.

American Foundrymen's Association. Annual convention, Buffalo, N. Y., Hotel Statler, Sept. 24, 25, 26. Richard Moldenke, secretary, Watchung, N. J.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Canada

DRAFTSMAN, one who has had experience in machine tools; state age, particulars of experience and salary required; good prospects with large concern for right man. Box 282, Am. Mach.

Connecticut

TOOL MAKERS, machinists, erecting and assembling hands wanted at once. Bullard Machine Tool Co., Bridgeport, Conn.

FOREMAN, familiar with uptodate manufacturing methods on high grade engine or machine work, and capable of producing results with thirty to fifty men. In reply state experience and salary expected and give references. Box 578, Waterbury, Conn.

WE ARE LOOKING at the present time for a competent man to take charge of our telephone and sundry electrical departments; we want a man who has had experience in the manufacturing of telephones, automobile specialties, etc.; we can make a very nice proposition to a man who knows how to handle men, who is resourceful, and who is capable of developing a new line of goods. Address Standard Mfg. Co., Bridgeport, Conn.

DESIGNER—By large Eastern manufacturer of machine tools, machinery and mechanical specialties, a chief designer of proven ability; a record of achievement is essential, and all applicants to receive consideration must be thoroughly explicit in describing their records; past and present employers, age and salary expected should be stated; all applications will be treated with strict confidence and no inquiries regarding any will be made without first consulting applicant. Box 245, Am. Machinist.

Florida

DRAFTSMAN — $300 scholarship — Wanted, next fall, neat, experienced workman as instructor; promptly send age, education, and full particulars. Professor Wiechardt, University of Florida, Gainesville.

Illinois

DRAFTSMEN AND TRACERS — We are constantly in need of the services of first-class draftsmen and tracers; some men are required on tool work and it is possible to place some on detailed and assembled drawings of agricultural implements. Applications requested addressed David Bradley Manufacturing Works, Bradley, Ill.

Indiana

HARDENER, one with large experience in hardening all kinds of steel gears. Box 236, Am. Machinist.

FOREMEN — A growing automobile factory is in need of foremen; state fully your experience, give age and salary expected. Box 293, Am. Machinist.

Iowa

MECHANIC, first class, capable of handling gear cutting in a large factory in Iowa; must be familiar with all kinds of gears, bevel, spiral and spur. Box 253, Am. Machinist.

Maryland

DRAFTSMAN, experienced in high-speed stationary engines. Box 227, Am. Machinist.

DRAFTSMEN on steel hulls for barges; detail work; permanent positions to competent men. Box 250, Am. Machinist.

DRAFTSMEN, eperienced on general heavy machine work, steam engines and steel hulls; state age and experience. Address George Smith, 709 Second St., Canton, Baltimore, Md.

Massachusetts

A GERMAN-AMERICAN, who can talk both English and German fluently, and who has a practical knowledge of small tools, to represent a large manufacturing concern throughout Germany. Box 284, Am. Machinist.

DESIGNERS AND DRAFTSMEN, accustomed to rotary and flat-bed printing presses; excellent position for those who can qualify; apply giving former positions and references, salary expected, also age and if married. Box 237, Am. Machinist.

DRAFTSMEN, by a large pump manufacturer, with several years' experience, capable of detailing from layouts and doing simple designing under direction of leading men; state fully experience, education, age, references, pay expected, etc. Address "Draftsman," Box 285, Am. Machinist.

Michigan

FOREMAN in machine department of firm making hoisting machinery; progressive, hustling, production man; good chance for advancement to more important position for right man; state experience and wages. Box 283, Am. Machinist.

New Jersey

TOOL MAKERS, experienced, understanding erection and care of grinders and automatic machinery; also lathe hands for Pratt & Whitney and Gridley machines. Wasson Piston Ring Co., 1123 Clinton St., Hoboken, N. J.

New York

DIE MAKER, first-class, capable of laying out and making dies for gas-stove work. Reply by mail to Box 281, Am. Machinist.

OPERATORS—Automatic screw machine, on Brown & Sharpe and Acme machines; state experience and wages expected; references required. Address Camera Works, Eastman Kodak Co.

MECHANICAL DRAFTSMAN, thoroughly competent, who has a complete knowledge of flour blending, sifting and weighing machinery; give experience, references, salary expected, etc., in first letter. Box 189, Am. Machinist.

FOREMAN for department in assembling machine tools; none wanted but a hustler that can produce results; unusually good opportunity for the right man; state age, experience and salary expected. Box 295, Am. Machinist.

FOREMAN, thoroughly familiar with building special and automatic machinery; must be first-class mechanic, with experience in handling men, and producing results; state experience, age and salary expected. Box 296, Am. Machinist.

Ohio

SUPERINTENDENT, machine shop or gas-engine foreman, thoroughly acquainted with gas-engine construction. Box 278, Am. Machinist.

DIE AND JIG MAKERS, first-class, on high-grade telephone work; state experience and wages. American Automatic Telephone Co., Urbana, Ohio.

DESIGNER, with experience on machine tool work, preferably lathes and their attachments; applicant must have had several years' experience in the shop as well as the drafting room, and be capable of instructing his assistants; please do not apply for this position unless you are sure you can fill the above requirements; liberal salary and fair treatment assured. Box 256, Am. Mach.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

OPERATORS — First-class automatic screw-machine operators, familiar with Cleveland machines; steady work. Apply to Flannery Bolt Co., Bridgeville, Penn.

MECHANICAL DRAFTSMEN, experienced in the design of motors, generators and detail apparatus, such as controllers, switchboards, circuit breakers, etc.; state experience and salary expected; only first-class men need apply. Address "Chief Clerk," Engineering Department, Westinghouse Electric & Mfg. Co., East Pittsburg, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wisconsin

FOREMAN, to assist general foreman of tools in automobile-part manufactory; must have thorough knowledge of modern jigs, fixtures, punches and dies, and have successfully held a like position on automobile parts, or equal; state full particulars and salary expected. Box 222, Am. Machinist.

FOREMAN, to take complete charge of grinding section in automobile-part manufactory; must have successfully handled such a position on automobile parts, or equal; this section includes universal, surface and rough grinding, also polishing; state full particulars and salary expected. Box 221, Am. Machinist.

BECAUSE of the rapid growth in our business we are constantly on the lookout for keen, able and practical men in the various departments of our works; for men above the average such positions offer splendid opportunities; in addition to our assembling rooms, we operate our own machine shops, drop forge plant, foundries and body works and invite correspondence from men whose experience convinces them that their ability is above the ordinary; one-third of our present employees have been with the management of this company from eight to twenty-six years. Address Factory Manager, The Thomas B. Jeffery Co., Kenosha, Wisconsin.

Positions Wanted

Illinois

GENERAL FOREMAN, 20 years' uptodate experience, thorough mechanic and producer; Middle West; employed; A1 References. Box 291, Am. Machinist.

Indiana

IGNITION EXPERT, at present employed by leading firm in this country, would like to make a change; for the last two years assistant superintendent; first-class mechanic and able to get results where precision work is required. Box 230, Am. Machinist.

Massachusetts

TOOL MAKER AND INSPECTOR, competent; 13 years' experience on tools, dies, automatic machines, experimental work, and as inspector, 32 years, married, steady, well recommended, with executive ability, wants position as foreman of machine shop. Box 286, Am. Mach.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 275, Am. Machinist.

DRAFTSMAN, with long experience on mill work and machinery wishes position, New York City or vicinity. Box 298, Am. Machinist.

FOREMAN—Thoroughly experienced on electric oxy-acetylene welding, is desirous of making a change; best of references. Box 288, Am. Machinist.

FOREMAN, pattern maker, wishes to make a change; ten years foreman on all classes of work, including gas engines, also foundry experience. Box 290, Am. Machinist.

OFFICE MANAGER or salesman, expert in shop accounting, cost keeping, drafting, buying or selling; 32 years old. Address "Salesman," 621 Forty-sixth St., Brooklyn, N. Y.

MACHINERY SALESMAN will consider connection with a manufacturing company; have had experience both in office and factory; can give best of references. Box 289, Am. Machinist.

MECHANICAL ENGINEER, graduate, 30, wishes to represent manufacturer in New York, or assist present agent; experienced in machinery; steel expert; excellent experience shop, office, traveling. Box 280, Am. Machinist.

MECHANICAL ENGINEER, also electrical, at present manager of plant manufacturing automobile gears and parts, desires change; position with a future rather than a high salary desired; undoubted reference as to character and ability. Box 270, Am. Machinist.

CONTEMPLATING to withdraw as a member of a firm where I have been engaged for a number of years on designing and manufacturing electrical mechanical instruments, special machinery, tools, jigs, dies, etc.; I am well conversant with modern methods; can conduct a plant to best advantage; able to handle English and German correspondence; could some reliable concern use my service and appreciate untiring efforts? Box 265, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

MECHANICAL ENGINEER, designer, technical graduate, practical shop and office experience in general and marine work; would consider sales department. Box 294, Am. Machinist.

SUPERINTENDENT wishes to make permanent connection with Eastern concern; American, 42 years old; 20 years' experience in general manufacturing and making light automatic machinery; not one of the know-it-all kind, but do know how to make good; machinist and tool maker by trade; would be pleased to call on party if so desired, or to be seen at present location. Box 292, Am. Mach.

Pennsylvania

FOREMAN of repair, jobbing or small manufacturing shop, by married man, age 28; have had five years' experience as foreman of repair shop at large tinplate mill; have had 4½ years' experience in jobbing and manufacturing shops and seven years in rolling mill shops; good at rigging up for jobs not suited to equipment; good references. Box 269, Am. Machinist.

Wisconsin

GENERAL FOREMAN—A-1 machine-shop and tool-room foreman; nine years' experience; first-class mechanic with university education; thoroughly competent, sober, reliable and up to date; output increased 83 per cent. at last place; wants position after June 15 as general foreman, or assistant superintendent of medium size plant; salary, $1800; best references; satisfaction assured. Box 287, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

A line of medium weight machinery to manufacture on contract. Box 297, Am. Machinist.

Punches and dies for blanking and forming metal. McCall Machine Works, Rochester, N. Y.

Work for 2x24 Jones & Lamson lathes and work for automatic gear cutters wanted. Box 267, Am. Machinist.

For Sale—1 B. & W. boiler, 520 hp., with Treadwell dumping grates, for immediate delivery. Western Electric Co., 463 West St., New York City, Dept. 115.

For Sale—One 8"x24" Allis-Chalmers Corliss engine; one four-spindle Turner cock grinder; first-class condition. For prices apply to J. E. Lonergan Co., 211 Race St., Philadelphia, Penn.

I want well equipped factory to take over manufacture of small patented article for automobile trade; perfected and on the market; will bear rigid investigation. Box 279, Am. Machinist.

Plant wanted, equipped to make sheet-metal parts; we have the article to make which is patented; also factory building; excellent opportunity for jobbing shop to get in on a staple article. G. W. Dulaney, 568 Mickle St., Camden, N. J.

Machine shops and foundries desirous of manufacturing and marketing a profitable specialty, in the line of fixture, device or machine requiring but little capital, should communicate with the Engineering Service Co., Box 463, Williamsport, Penn.

Proposals for Ordnance Supplies—Watervliet Arsenal, Watervliet, N. Y., April 25, 1912—Sealed proposals, in triplicate, will be received until 1 p.m., May 25, 1912, for furnishing steel, hardware, forage, fuel, oils, etc., during year ending June 30, 1913. Information furnished on application. Lt. Col. W. W. Gibson.

We have a thoroughly equipped shop for model and experimental work, which we do in connection with our specialty of punches, dies, jigs, fixtures, etc., for the production of interchangeable parts; we also do light manufacturing. Nestor Manufacturing Co., Inc., 40 West 13th St., New York City.

A Confession

We are guilty! And have decided to make a clean breast of it—here it is.

1. Any concern that does business under any system of protection is accepting graft—but all of 'em want to keep it, and yell murder when it is proposed to reduce the protection by a penny.

2. The one-cent-a-pound postage on newspapers is a form of protection—it is government pap, a subsidy—the Postmaster General says so, and that that is the reason of the deficit. Never mind the law. Never mind the hundreds of businesses founded on that law. Upset 'em.

3. Canada carries her newspaper mail free in a forty-mile radius and anywhere in the Dominion for a quarter of a cent a pound—and her post office department shows a big profit. But, of course, our politician ridden department can't do that—who expects it to?

4. This concern sends practically all its papers through the mail at second class rates.

5. We acknowledge receipt of letters and envelope fillers from our advertisers containing the assertion that if the Postal Reform League can force the newspapers and magazines to pay two cents a pound, that "we, the people" can have one cent letter postage, but—

6. The newspapers are fighting this tooth and nail (sic).

7. *We wish to announce here and now that this change would save us money, and we would welcome it like finding a pocket book.*

8. We confess that when the government made its first investigation some four years ago, our President proposed a plan of charging the present rate of one-cent-a-pound for carriage alone and a fraction of a cent *per copy* for delivery. This would have more than doubled the revenue from mail matter of the second class and made the papers receiving service pay for it.

9. We confess that later on he proposed a uniform rate for all *printed matter*, fully routed and delivered to a post office, as required of newspapers.

10. We confess that none of these plans were very popular with publishers, or at Washington.

11. We confess that the object of these suggestions to increase our own expenses were made for the purpose of taking the censorship off publications, and putting publishing on a par with other commercial enterprises.

12. We confess that all civilized countries carry all forms of disseminating information at the lowest possible rate.

13. We confess that the technical press of America is the best in the world and admired and respected in every foreign country except the District of Columbia.

14. We confess that this same technical press is expected to defend the sacred cow of protection set up before the high altar of the industry which each paper represents, and

15. To be glad that there are more foreign than American papers entered at the New York Post Office *for transportation through our mails at one cent a pound*, and

16. Applaud the fact that such papers as the AMERICAN MACHINIST, when it establishes an edition in Europe, partly printed in America, must pay a rate many times as high as we give to papers, entirely printed abroad. Hurrah!

17. Notice. Members of the League need not write on the margin of their yowls that if it wasn't for *us*, "they" (whoever that may be) would have one cent letter postage—*we are right with you*, and will petition Uncle Sam to make that trade at once.

18. But, we hang our heads in shame when this great Country of ours confesses that it can not conduct its post office department as well as Canada for instance. No wonder the Canucks wouldn't "reciprocit" with us. They have us skinned on a lot of things, and it looks as if the distribution of information essential to the whole people is one of the things.

THE OLD MAN.

Manufacturing Cotton Gin Parts

By Ethan Viall

An unusual grinder for grinding irregular pieces of variable width.

Special machines used in manufacturing roach-back, needle-pointed gin saws of thin steel in large quantities.

An interesting method of making spacing blocks of sheet metal.

If Eli Whitney, the inventor of the saw gin used to separate the cotton seed from the lint, could see the machines in use today he would scarcely recognize the evolution of his idea.

Two great epochs mark the history of the cotton industry; one being Whitney's invention, and the other the perfecting by R. S. Munger of the handling of cotton by air. At present practically all the cotton, except when being picked or when in bales, is handled by air.

It is not the intention here to go into a detailed description of the operation of a cotton gin, but a fair idea of a model four-gin installation may be obtained from Fig. 1. In this halftone *A* represents a bin of cotton just as it comes from the field. From the bin it is sucked up through the large tube *B* and carried to the separator *C*, from which it is taken to the four gins by means of the distributor belt *D*.

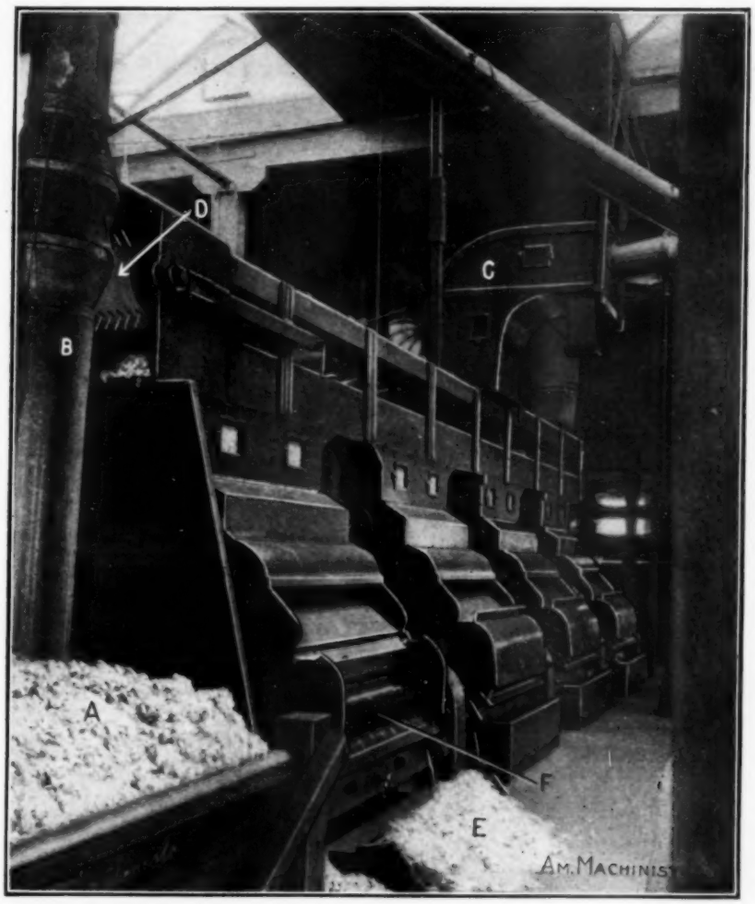


FIG. 1. A MODEL FOUR-GIN INSTALLATION

The cotton is worked down through the gins, till finally it comes out free from dirt, hulls and seed, as shown at *E*. The cover over one set of ginning saws is thrown back at *F*. These saws and the method of mounting and using them are more clearly shown in Fig. 2.

As the halftone shows, the saws are placed on a shaft 60, 70 or 80 in a gang, depending on the size of the gin, each saw being separated by a space block. The gang of saws is so mounted that each saw projects between two irregular pieces of iron called ribs; the idea being that the needle points of the saws will catch and draw the cotton down in between the ribs, leaving the seeds to drop down on the outside, the cotton being removed from the saw teeth by a revolving cylindrical brush set back of them.

The ribs used are made of the best grade of charcoal iron and are chilled, so as to be hard where the saw passes in order to insure long life. Having these ribs as hard as possible is especially desirable when ginning cotton grown on sandy soil, as such cotton is apt to be full of grit.

GRINDING GIN RIBS

By referring to the rib *A*, lying on top of the box, it will be seen that the back of the rib is cut away, making it somewhat triangular in cross-section, with rather thin edges and one flat surface. This flat surface is ground and polished by hand and the end holes are drilled and countersunk, then the edges are ground so that all the ribs will be exactly the same width.

Inspection of the slots between the ribs in Fig. 2 will show that these slots are not the same width all the way down. This variation in width is obtained in a peculiar manner on the specially fitted grinder shown in Fig. 3.

The rib to be ground is placed in the carrier at *A*, being located by pins in the drilled holes and held in by an overhanging piece at one end and a spring plunger *B* operated by the cam lever *C*, at the other. A double-rail cam-track is placed on each side of the grinding wheels on which the rollers on the carrier run. Only one of the tracks *D* is visible at the back, but both the front ones are shown at *E* and *F*. The front and back tracks correspond in such a way that the flat surface of the rib is practically square with the faces of the wheels at all times, yet the height above the centers of the wheels is varied so that the difference in width is obtained where wanted.

The grinding wheels are mounted on slides so as to be easily adjusted, and a handle *G* is placed on the carrier so that the operator can hold it firmly as he pushes it over the tracks. Unusually efficient dust-hoods are provided to carry off the metal and grit.

MAKING GIN SAWS

The material used in making gin saws is a special grade of 0.037 in., imported English steel, which is first blanked out into 10- or 12-in. disks, as shown in Fig. 4, and then centered as shown in Fig. 5.

In the centering operation a plain piercing punch is used and the disk is located by means of the two pins *A* and *B* at the back of the die, against which the disk rests.

CUTTING THE TEETH

After coming from the punch presses, the saw disks are placed in the machine shown in Fig. 6 and the teeth cut. This machine was made by the Van Winkle Gin Machinery Co., and will cut teeth in

either 10- or 12-in. disks with but slight change of adjustment.

The saw blank is placed on a plate over the end of a vertical spindle. A large plate, or washer, is next laid over it and securely clamped down with a nut, the whole blank being held between the two plates, only enough of the edge being exposed to give room for the teeth to be cut, as shown at *A*.

The vertical spindle carrying the saw has an indexing plate *B* at its lower end. This plate has two rings *C* and *D* on it, in which are cut ratchet teeth. The inside ring *C* has the same number of teeth as are cut in the 10-in. saws, and the outside ring *D* has the same number as a 12-in. saw which are 235 and 264 respectively.

This indexing plate is operated by a pawl *E* and the lever *F* worked by an eccentric at the back of the machine. As this plate is revolved the punch *G* cuts the same number of teeth in the saw blank as there are teeth in the indexing ring being used.

Sufficient adjustment of the vertical spindle with relation to the punch, for the two sized saws made, is obtained by means of the handwheels *H* and *I* which move the main bearing of the spindle. Slotted braces on the lower bearing are loosened while making adjustments, and then tightened, making the spindle as rigid as necessary.

The punch is run by means of the lever *J* and an eccentric connecting rod shown at *A*, Fig. 7. In this halftone the eccentric that works the punch is shown at *B* and the eccentric for operating the indexing lever at *C*. It will be seen from this that the length of the stroke of the indexing lever cannot be changed, and that the teeth in both the indexing rings must be equally spaced. The handwheel *D* is used to operate the machine when adjusting or testing, and the lever *E* is simply a belt shifter.

Straightening of the saws after punching or whenever necessary is, of course, done by hammering on a flat-top anvil in the usual manner.

Beveling Sides of Teeth

The teeth of the saws have what is known as a "roach back," giving them strength; have a well rounded throat in order not to cut the cotton, and are finished to a needle point, and in order to give the teeth the required point they are filed in two different filing machines.

The first filing operation is done on the machine shown in Fig. 8, in which the saws are placed at *A* and *B* and the points filed slightly bevel, with flat files. The saws are held on the top plates of their respective spindles by a swinging spring-yoke *C* which may easily be swung at right angles and the saws removed.

The spindles are revolved by worms and worm gears as shown at *D*, the worms being run by a belt from the pulley *E*, which in turn is belted to the pulley *F* on the crankshaft. As the saws revolve, the flat files are worked back and forth by the cranks *G* and *H*, through the connecting rods *I* and *J* and the sliding rods *K* and *L*, to which the files are fastened.

As soon as the saws have made one revolution, the yoke is lifted and swung around, the saw *A* is removed, and saw *B* is turned over and put in its place, a new saw being put on at *B*. In this way one saw is finish-beveled on both sides of the teeth at every revolution of the work spindles.

One operator runs several machines and in order to prevent the machines from running over, an automatic stop is placed at *M*, which strikes the trip *N* and releases a catch on the lever *O* which is pulled outward by the cord and weight *P* and shifts the belt *R* over onto the loose pulley *S*. These filing machines work very rapidly and it keeps an operator moving to supply them.

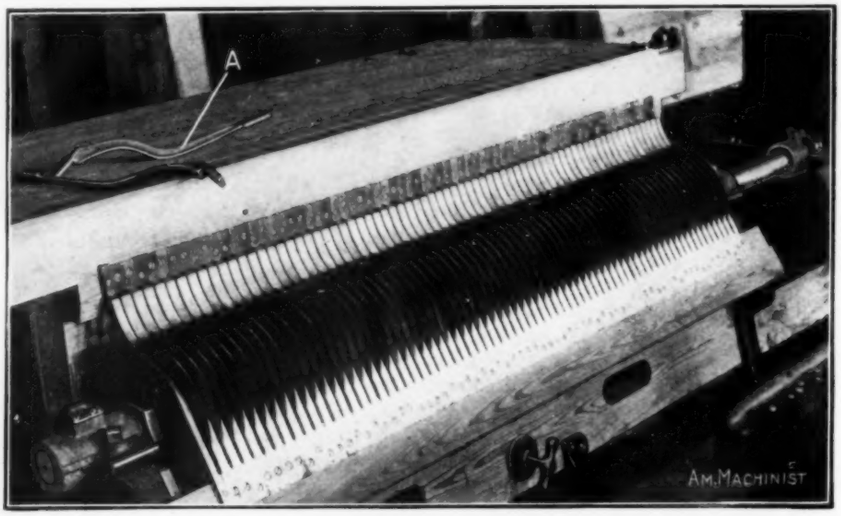


Fig. 2. The Way Gin Saws and Ribs Are Placed

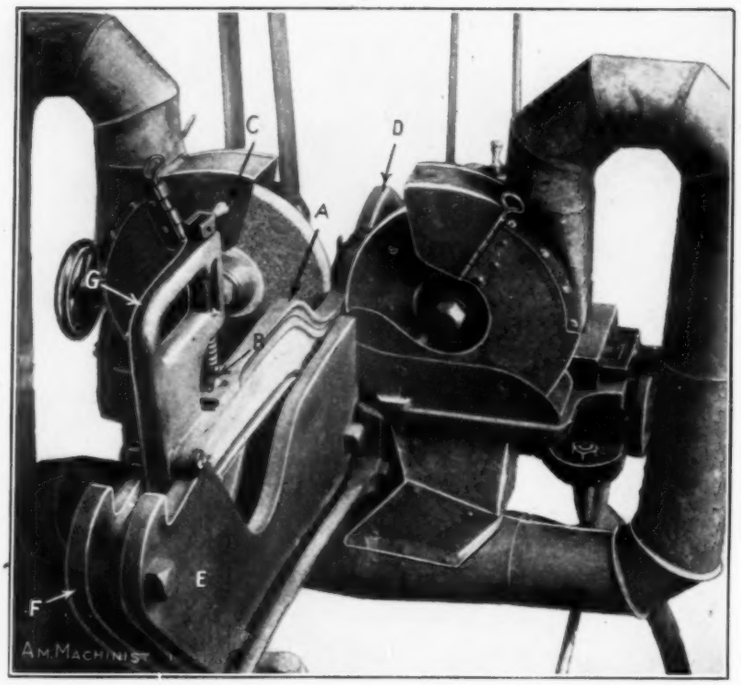


Fig. 3. Special Gin-rib Grinder

Pointing and Polishing

The pointing of the teeth is done in another filing machine shown in Fig. 9. This machine differs from the one just described principally in having the back of the frame dropped down, so that the crankshaft hangs lower, giving a greater angle to the files. Three-cornered files are used and the angle at which they

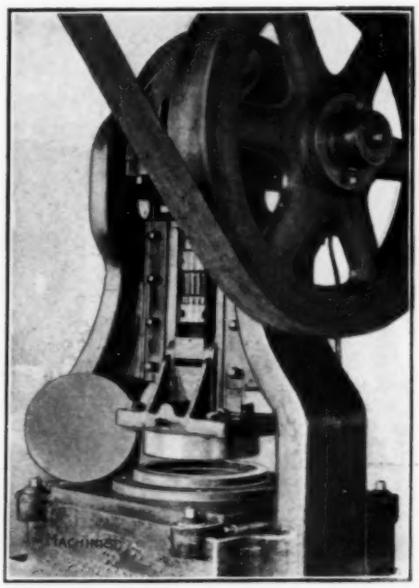


FIG. 4. BLANKING OUT SAWS

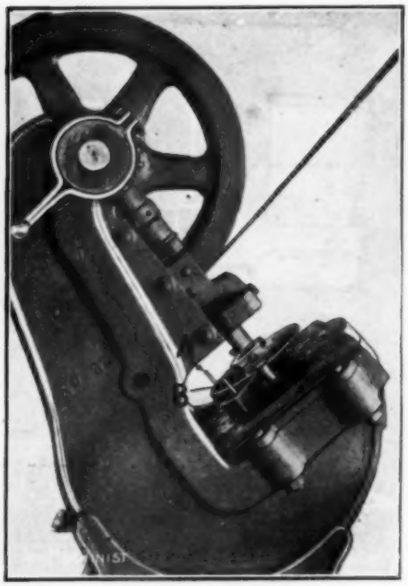


FIG. 5. PUNCHING THE CENTER HOLE

work may be varied somewhat by adjusting the carriage by means of the slotted brackets and bolts at *A* and *B*.

The turning of the saws while being filed is accomplished in exactly the same way as on the beveling machine, no attempt at accurate indexing being made, the saws, of course, being speeded as nearly correct as possible with a belt.

In order to allow for any slight discrepancy in the movement, the files are allowed a certain amount of play sidewise, so that they automatically adjust themselves. As soon as the saws have made one revolution they are shifted as in the previous case, so that one saw is finished at each revolution.

After the saws have been filed, they are placed on a mandrel and polished absolutely smooth by running them in sand as shown in Fig. 10. They are first run backward for a while and then run forward, the idea of getting them absolutely smooth being, of course, to avoid the

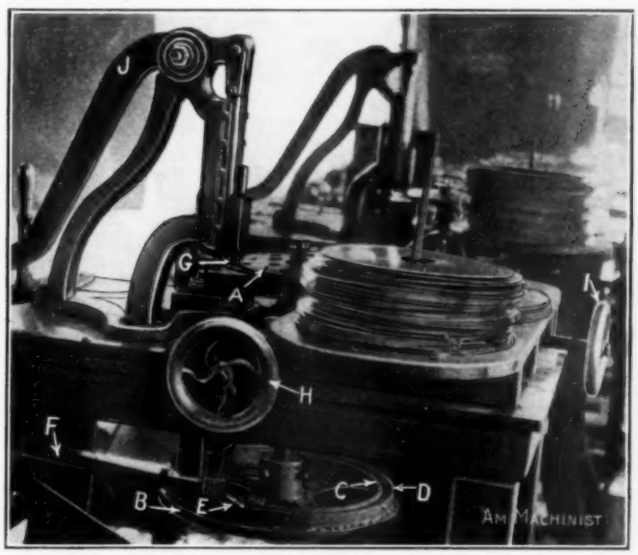


FIG. 6. PUNCHING THE TEETH

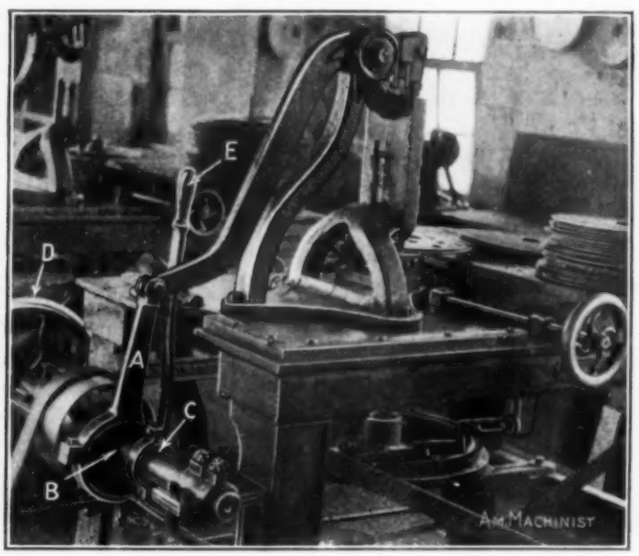


FIG. 7. REAR VIEW OF MACHINE

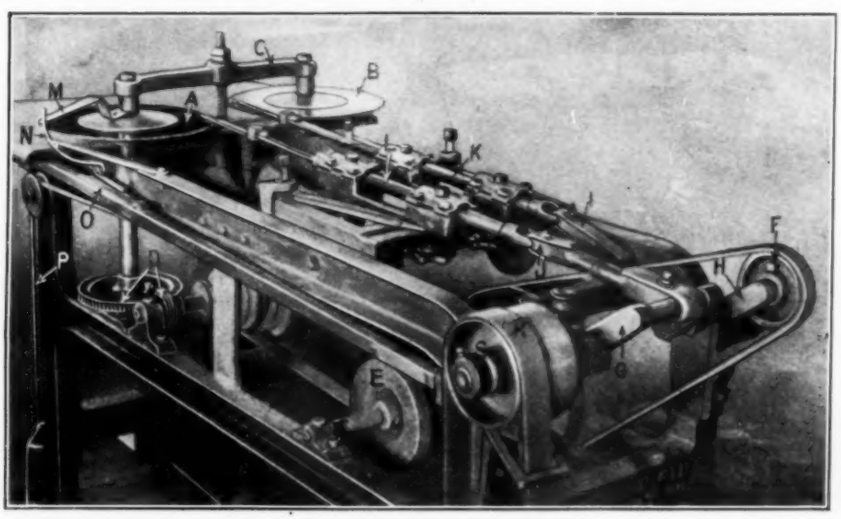


FIG. 8. BEVELING THE TEETH

tendency of cotton lint to cling wherever there is the slightest roughness.

MAKING SPACE BLOCKS

Space blocks, used to separate the saws a given distance on the shafts on which they are carried, were formerly made of wood cut crosswise of the grain, but as it was impossible to maintain exact sizes with them, they are now made of sheet metal.

Strips of sheet steel are punched (not sheared) out so as to have the width as near perfect as possible. These strips are then spot-welded over a form in the electric welder, shown in Fig. 11, the idea, of course, being to produce bands as nearly the same size as possible. A number of the welded bands are shown on the floor at the right of the machine.

These bands are next crimped around a stiff metal disk in the machine shown in

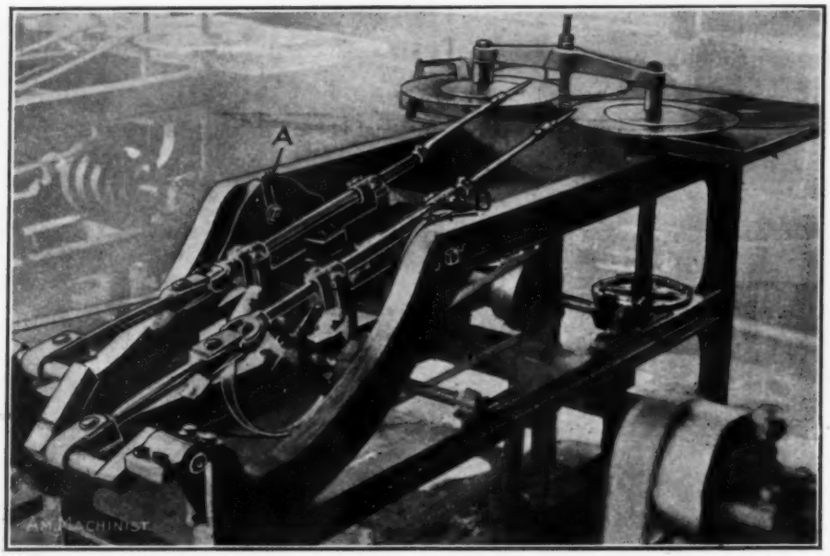


FIG. 9. POINTING THE TEETH

Fig. 12. At *A* is shown a welded band and at *B* a punched disk, while at *C* and *D* are completed space blocks. In forming or assembling these blocks a disk is placed on a stub mandrel in the center of the half gear *E*. A band is then placed over the teeth of this half gear and the lever *F* is pulled, bringing the half gear *G* in close to *E* with the disk between them and the band on the outside of the teeth.

The machine is now started and the gear *H* rolls or crimps the band onto the disk, punches like *I* being set into the gear *H* in order to perforate the band in several places, and fix it firmly on the edge of the disk. Of course, it must be understood that the flat place *J* in the gear *H* is over the two half gears when the disk and band are slipped into position, the gears being set as shown only to bring out all the parts. As soon as the crimp is completed the stop *K* hits the end of the rod *L* and throws out the clutch, stopping the machine.

SIZING THE BLOCKS

While very carefully made, the space blocks are bound to vary slightly in thickness, which is obviated by running them under a hardened-steel roller as shown in Fig. 13, the edge of the block being guided by a semicircular lever, which is pivoted so that the block may be easily worked out from under the roll after it has been sized.

TRUING SAWS ON THE SHAFT

The saws and space blocks are assembled 60, 70 or 80 in a gang as the case may be, on a shaft and clamped between heavy washers and nuts. The next operation is to straighten the saws so that they will run true. This is done on the device shown in Fig. 14. The shaft is held in half boxes with adjustable stops at each end to prevent end play. Above and slightly back of the shaft, supported by brackets, is a bar *A* on which is a sliding piece *B* carrying the pointer *C*.

The bar *A* has two splines cut its entire length. These splines are on opposite sides of the bar and each is drilled with holes properly spaced for a certain gang of saws. The drilled spline that is underneath is used for the job in

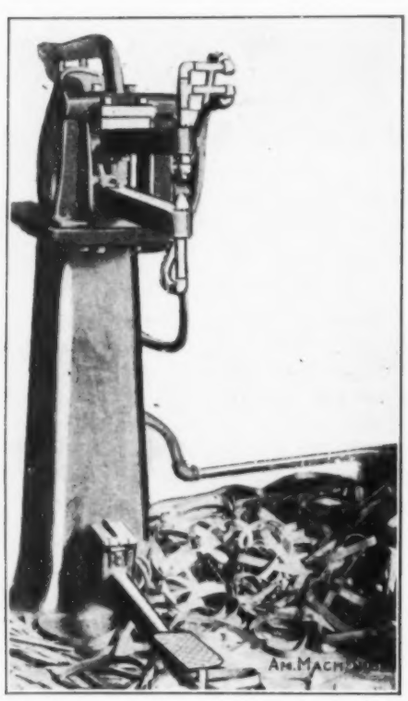


FIG. 11. BAND-WELDING MACHINE

FIG. 10. POLISHING SAWS IN SAND

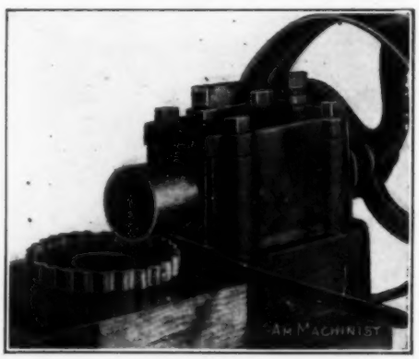


FIG. 13. SPACE-BLOCK SIZING ROLL

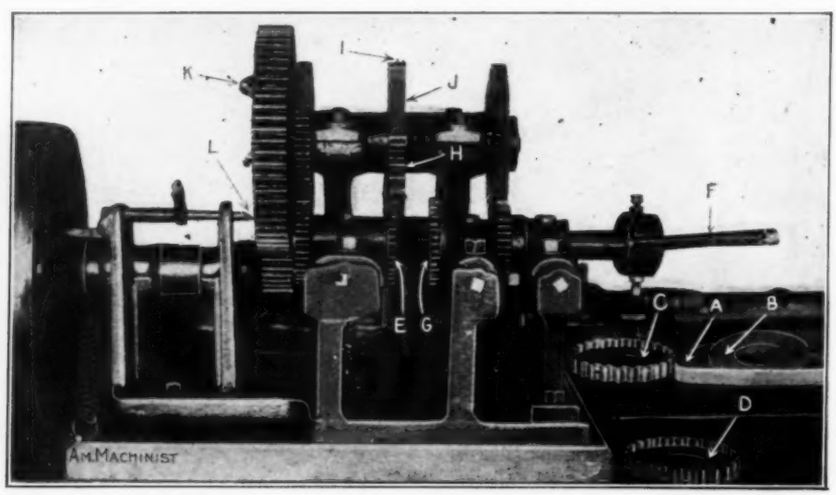


FIG. 12. SPECIAL CRIMPING MACHINE

hand, the bar being easily set for whichever spacing is desired by removing the key *D*, turning the bar and again inserting the key. A pin *E* held by the loop *F*, is used to set the slide *B* for the different spaces.

In starting to true a gang of saws, the operator first adjusts his shaft lengthwise so that the bar spaces and the saw spaces coincide, then with the pointer set for the first saw, he takes the wood block *G* in his left hand and resting this on the teeth of the saws most convenient to him, turns the gang. As the saw under inspection varies from the end of the pointer, he springs it back in line with the slotted tool *H*, held in his right hand. When one saw is trued the slide and pointer are moved along the bar to the next hole and the second saw trued as before, the operation being repeated till the whole set is lined up.

Sharpening Dull Saws

After gin saws have been in use a while they must be resharpened, and this may be done on the double-head machine, shown in Fig. 15, without removing the saws from the shaft. In using this machine a pulley *A* is slipped on the shaft and is belted to a pulley on the machine to furnish the feed. One revolution of the gang is made and then the carriages are moved along a space and another revolution made. One of these carriages is shown more in detail in Fig. 16.

The movement is somewhat similar to that of the filing machines already described, with the addition of a gumming device. The three-cornered files *A* and *B* are run by the pulley *C* which has a crank on each end of its shaft. These files have a certain amount of play, as in the case of the factory machines, in order that they may adjust themselves to the work.

The gumming is done with a rotary file *D* run by a belt on the pulley *E*. The bracket carrying the gummer is made to swing, so that the rotary file is fed in and out as the saws are revolved, the motion being given the bracket by means of a connecting rod *F* and a crank at the back of the machine.

In preparing this article, photographs and material were obtained at both the Birmingham and Avondale plants of the Continental Gin Co., Birmingham, Ala., and especial thanks are due to Superintendents F. E. Smith and R. C. Munger, of the two plants, respectively, for permission to use the material, and also to A. W. Markel, department foreman at the former, and Robt. M. Silliman, assistant superintendent of the latter plant, for personal interest and assistance in the work.

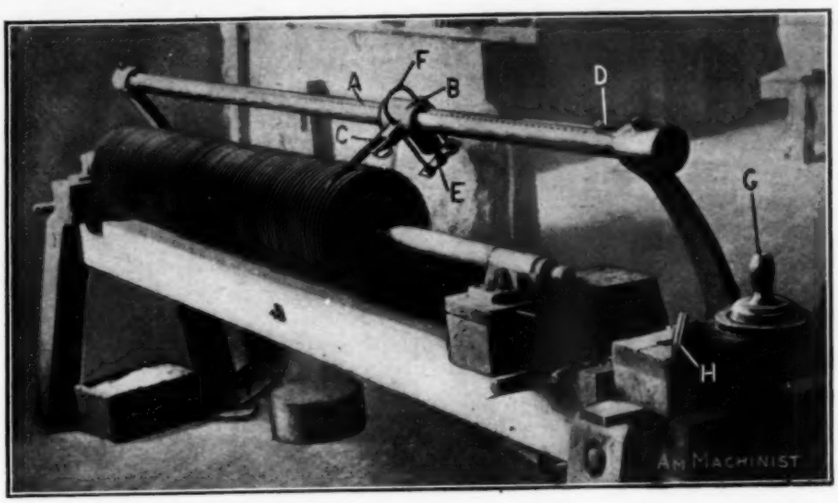


Fig. 14. Device for Lining Up Assembled Saws

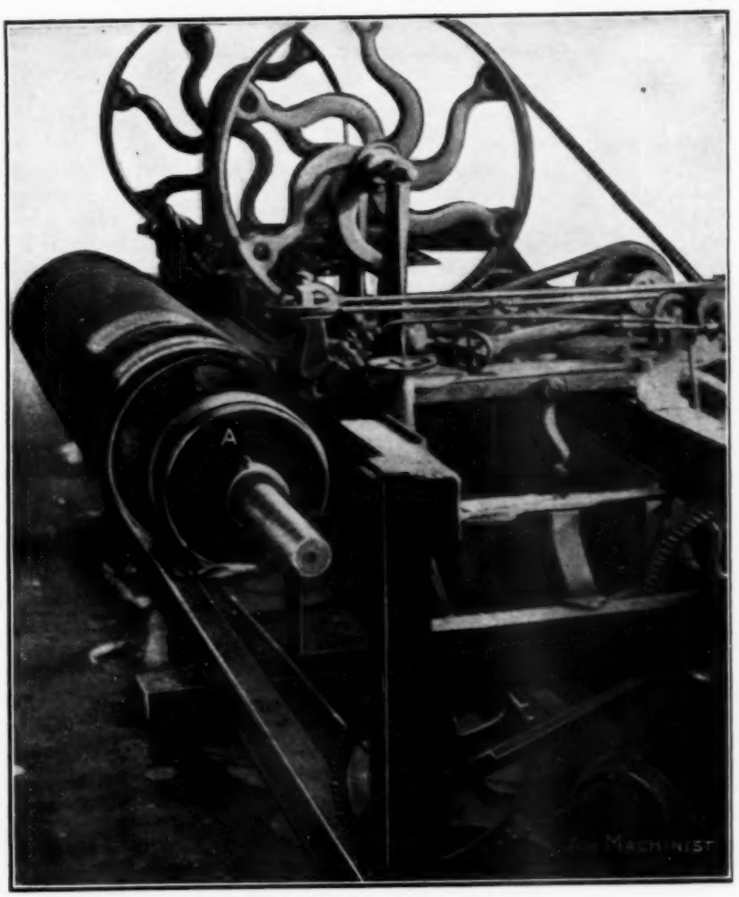


Fig. 15. Machine for Resharpening Dull Saws While on the Shaft

Expediting Factory Orders

By Charles F. Scribner

In the development of a new product it became necessary to materially increase the number of employees of the drafting and tool departments, and as the volume of the work to be handled was also increased, it became necessary for the foreman of the tool department to have a thorough understanding as to the urgency of "Rush" orders sent to his department. The following instructions, regarding this subject, were issued to those concerned:

In order to expedite the production of tools, fixtures, gages, etc., most needed to carry on the manufacturing operations without unnecessary delay, use will be made, by the order clerk, of "Urgent, start immediately" and "Special, don't delay" rubber stamps for stamping orders to which it will be necessary for the foremen receiving same, to give special attention.

"URGENT, START IMMEDIATELY" ORDERS

This stamp will be used upon all orders for tools, fixtures, gages, etc., the need of which is holding up the production of some part required to keep up assembling production.

Orders bearing this stamp will have precedence over all other work in process, and immediate report must be made to the superintendent upon their receipt, if for any reason the work cannot be completed before the date given on the same.

This stamp can only be used upon orders with the approval of the superintendent and such orders must be O.K.'d by him.

"SPECIAL, DON'T DELAY" ORDERS

This stamp will be used upon orders for tools, fixtures, gages, etc., which, while not needed as urgently as in the case of "Urgent" orders, will soon be required in order to provide parts for the finished parts stockroom.

Orders bearing this stamp will have precedence over all orders not stamped "Urgent, start immediately" and when once started they will be carried through to completion without interruption.

This stamp can only be used upon orders with the approval of the superintendent and such orders must be O.K.'d by him.

Both "Urgent, start immediately" and "Special, don't delay" orders must not, however, be issued until the urgency of the completion of the work to which they apply is admitted and approved by the superintendent.

Making a Small Turbine

The Max Machine Company, Clinton, Mass., makes a small steam turbine, to be used in connection with their soot extractor for boiler tubes. This turbine is a very simple affair, consisting of a rotor made up of two steel stampings, mounted in a suitable case and provided with a steam jet.

The two illustrations show how these are made. First a round disk is blanked out, as shown at *A*, while the dies at *B*, *C* and *D* show how the vanes or buckets are formed. Only one disk is stamped at each operation, the two finished disks being shown in place, in order to show how the right and left disks are formed in the same dies.

For stamping the vanes in the lower die *D*, only this and the intermediate die *C* are used. The shank shown in *B* is removed and screwed into the middle die *C*, which then becomes the upper die for the punching of the lower of the disks shown in the lower position.

A single stroke of the punch cuts and forms the vane, as can be seen in the finished rotor *E*, at the right.

To make the corresponding vane for the other side the shank is replaced in *B*, and *C* becomes the lower die. With this combination the disks shown in the upper position are stamped out, one being completed at every stroke of the press.

A somewhat different rotor is shown at the left in Fig. 2 and was formed in the same way. The present form, however, is that shown on the right, which has been found to give good results and is easier to form.

The large disk *F* shown behind is about 12 inches in diameter and is one-half the rotor for a larger turbine, which is used in connection with a blower for induced draft.

These will be made in the same way when the plant is fitted up for their manufacture, but for the present one bucket or vane is being punched at each stroke of the press, the work being indexed by a suitable mechanism on the bed of the press. This makes a very economical method of doing work of this kind, the cost of the dies being about the minimum for securing satisfactory work.

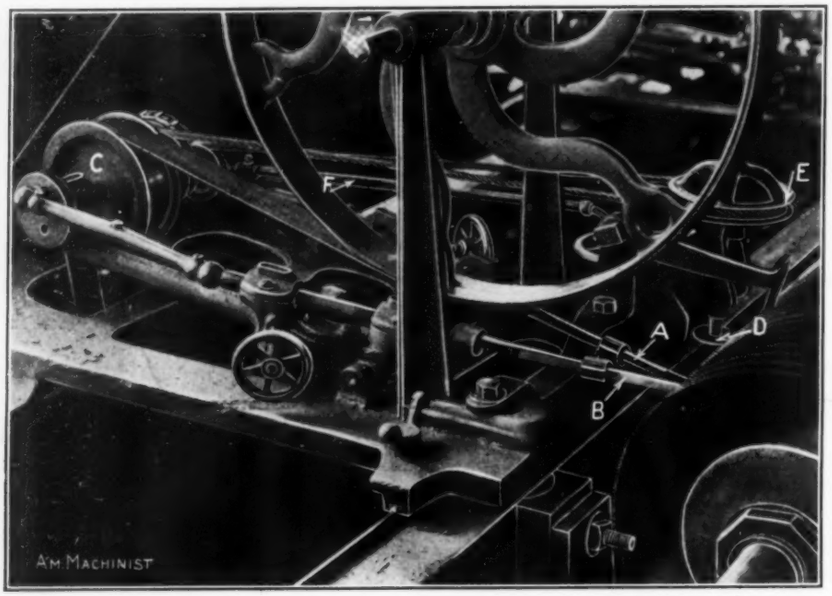


FIG. 16. ONE OF THE CARRIAGES OF THE RESHARPENING MACHINE

According to a bulletin just issued by the Census Bureau, 75,700 wage earners were employed in the manufacture of automobiles during 1909. This was an increase of 3279 per cent. over the number employed during 1899. The value of the products for 1909 was $249,202,000 or an increase of 5148 per cent. over the value of the products in 1899, when the preceding census was taken.

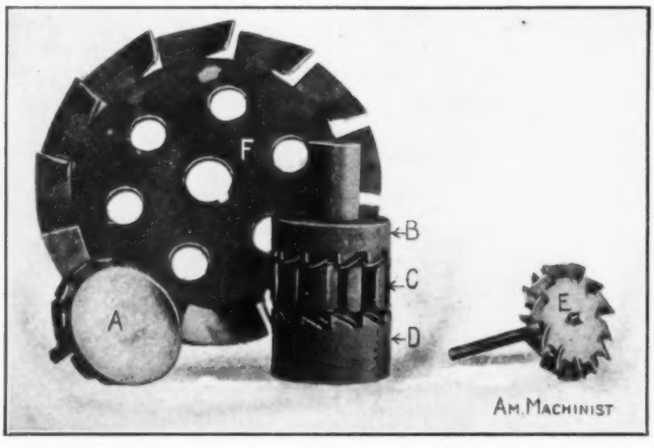


FIG. 1

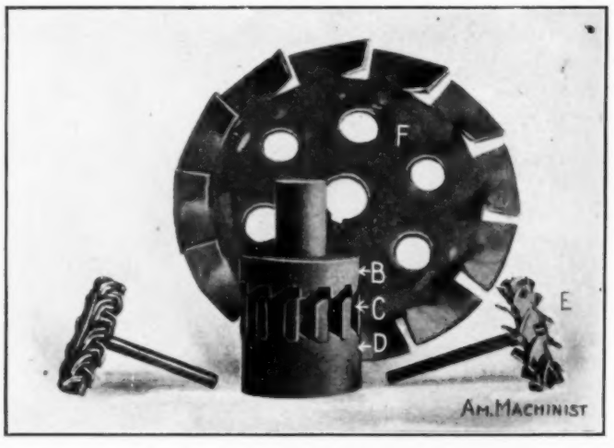


FIG. 2

DIES FOR MAKING A SMALL TURBINE ROTOR

Shop Lighting Maintenance Records*

By C. E. Clewell†

In a recent public gathering a practical shop man stated that a standard scheme is needed for the accounting of costs of shop lighting systems; first, because of the desire on the part of operating shop men to know definitely the operation and maintenance cost of every part of the shop equipment; and second, because those who contemplate the purchase of new lighting apparatus desire a standard basis on which to make comparisons of the various types of lamps.

This article is presented for the purpose of aiding in the solution of these problems, and while the notes are given somewhat in the way of a suggestion, the methods referred to are based, not on untried theoretical considerations, but on extended experience in the matter of shop lighting maintenance.

From the standpoint of the operating man, an accurate accounting of all maintenance expenses in the shop is desired, and as a starting point a definite and complete record of the lighting equipment as installed should be on file. This statement applies with equal force to the small as well as to the large shop, but it is apparent that the importance is even greater where the shop is of very large size, and where the lighting systems are distributed over an extensive area.

This record, which may be made up in the form of a chart, is of threefold advantage: First, as regards the information it affords of the exact nature of the equipment, and which permits of ready reference; for example, when taking stock of the apparatus of all descriptions in the plant. Second, as a basis when working up the complete maintenance at the end of each month. Third, as a guide in making a regular inspection of the systems from time to time, and when renewing, trimming or repairing lamps.

A record of this kind can be realized with comparative ease where the lighting apparatus is limited to one type of lamp. Where, however, the types of lamps are fairly large in number, and where the system is constantly being enlarged or changed, due to shifting conditions of work, considerable care must be exercised to maintain this record in an accurate form.

A convenient method of keeping this record is by the use of a blank book, at the top of the pages of which the types of lamps may be written, while the space immediately below may be utilized for recording the maintenance items. It is obvious that in a scheme of this kind individuality will enter into nearly every case. There is, however, a definite number of items which must be recorded to make the information complete, and, in addition to the enumeration of these items, an advantageous method, which has been worked out in the case of one large lighting system, will be given, in the hope that others may profit by the adoption of its good points.

Where many lamps of different sizes, such, for example, as the tungsten type, are used in addition to arc and Cooper-Hewitt lamps, the problem of an equipment record is more complicated than in those cases where only lamps of very large size are employed, first, on account of the larger number of units for a given floor area, and second, because of the likelihood of a large number of lamp sizes.

In one shop where, in addition to large-size lamps, tungsten lamps are also employed for the lower ceiling heights, a chart, as shown in Fig. 2, is made the basis of such a record. On this chart each of the several hundred distinct locations is recorded with the data, as indicated in the various columns. When a call comes for the renewal of a lamp from any of these locations, a reference to the chart shows the type of lamp to be used.

Much importance is attached to this feature of lamp recording, without which systematic maintenance becomes difficult and even impossible, due to the resulting confusion, as lamps of the wrong size are put into service because of a lack of guiding information.

Inspection Records

With lamps which do not require frequent attention, as is the case in the trimming and short-burning arc lamps, a regular daily inspection should be made to ascertain what lamps are out of service, due to burn-outs or needed repairs. This applies to tungsten, Cooper-Hewitt, long-burning arc lamps, and practically all types, with the exception of the short-burning arc lamp. This inspection is made the starting point of the maintenance record at the end of each month.

An inspection report, as shown in Fig. 2*a*, is used for tungsten lamps. On this all burned-out, blackened or missing lamps are recorded by the inspector in making his rounds each day. In the case of extra items, such as breakage of reflectors, reflectors in need of washing, and the like, the inspectors report more than is actually indicated on this report. The items recorded in the columns of this sheet are the ordinary ones encountered in the daily rounds.

*This is the eighth of a series of articles on shop lighting being written by Mr. Clewell for the American Machinist. There have already appeared in Volume 34: "Machine Shop Lighting," page 595; "Drafting Room Lighting Problems," page 686, and "Foundry Lighting Problems," page 1076; in Volume 35: "Shop Lighting Installation," page 777; in Volume 36: "The Artificial Lighting of Machines," page 127, and "The Upkeep of Shop Lighting Systems," page 501.

†Lighting expert, Westinghouse Electric & Manufacturing Co., East Pittsburg, Penn.

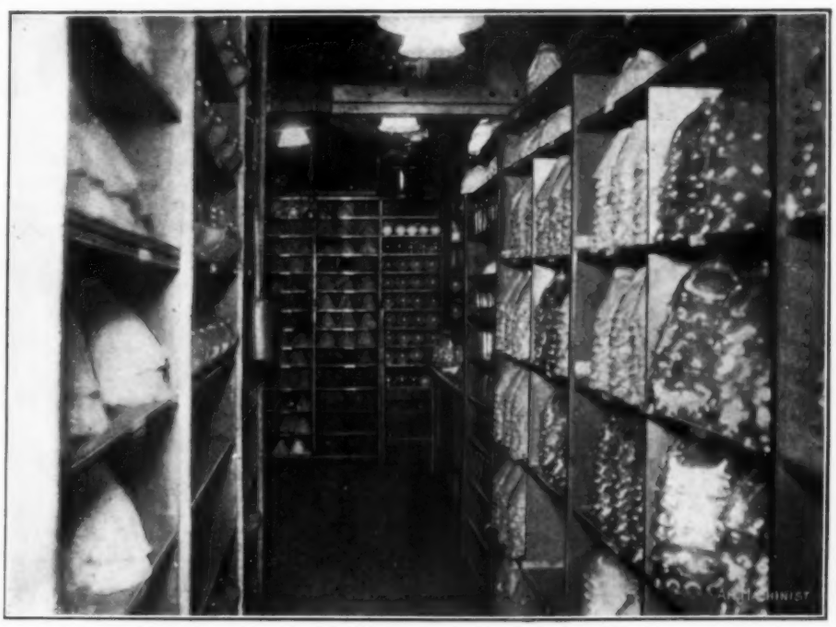


Fig. 1. Shelves for Storing Reflectors and Globes in Maintenance Department

The inspection report duly filled in is sent to the maintenance department in duplicate, and after the renewals are completed, one of the duplicate copies is returned to the inspector, as shown in Fig. 2*b*, where those lamps are indicated which, although reported as burned out, were found by the renewal man merely to be loose in the socket or to have gone out because of a defective fuse, also all lamps renewed between inspections and not noted on the inspector's report, as originally sent to the maintenance department. This returned and corrected duplicate is filed each day, and at the end of the month all lamps renewed are added up to show the total used. In smaller plants, this summation may be made by the clerk in the maintenance-department storeroom without difficulty.

Other Items for Record

In addition to the foregoing renewal items, the maintenance department also records all labor and each repair part used for the various types of lamps. The following notes will serve to show somewhat in detail the method by which this may be accomplished successfully.

Arc Lamps—All carbons or electrodes are recorded as they are issued, also the number of globes and each repair part. Fig. 3 indicates a typical tag, which is issued for each lamp that comes in for repair. This tag is attached to the lamp received, and as the repair parts are used they are indicated in pencil on the tag, which is then turned over to the clerk as soon as the lamp is sent out for service. Similar cards serve for other types of arc lamps, also Cooper-Hewitt and Nernst lamps with the requisite change in listed repair parts.

LAMP RENEWAL SHEET						DATE
Location Office Shop	Style of Lamp	Out	Black	Miss.	Fuse	Notes
Shop A, Col. 9-10	100-watt 110-v.	3				Reflectors Soiled
Shop B, Col. 1-2	250-watt 110-v	2 1			1✓	
Shop C, Col. 6-7	100-watt 110-v	1 3		1✓		
Shop D, Col. 12-13	100-watt 110-v	1				
Shop E, Col. 2-3	100-watt 110-v.	2 3				
Shop G, Col 8-9	60-watt 110-v.	1				
Shop P, Col 4-5	500-watt 110-v.	1				
Shop S, Col 30-31	250-watt 110-v.	1 2				
Shop T, Col. 41-42	100-watt 110-v.	2 1				
Shop W, Col. 7-8	60-watt 110-v.	1				

AM. MACHINIST

FIG. 2a. TUNGSTEN LAMP-RENEWAL SHEET AS RETURNED

CHART FOR TUNGSTEN LAMP SYSTEMS

Location	Number of Lamps	Lamps			Reflectors			Shade Holder	Mounting Height	Ceiling Height
		Size	Volts	Type	Size	Class	Type			

FIG. 2. FORM FOR RECORDING TUNGSTEN LAMP INSTALLATIONS

LAMP RENEWAL SHEET *Date*.....

Location (Office) (Shop)	Style of Lamp	Out	Black	Miss	Fuse	Notes
Shop A, col. 9–10	100-watt, 110-v	3				Reflectors soiled
Shop B, col. 1–2	250-watt, 110-v	2			1	
Shop C, col. 6–7	100-watt, 110-v	1		1		
Shop D, col. 12–13	100-watt, 110-v	1				
Shop E, col. 2–3	100-watt, 110-v	2				
Shop G, col. 8–9	60-watt, 110-v	1				
Shop P, col. 4–5	500-watt, 110-v	1				
Shop S, col. 30–31	250-watt, 110-v	1				
Shop T, col. 41–42	100-watt, 110-v	2				
Shop W, col. 7–8	60-watt, 110-v	1				

FIG. 2b. TUNGSTEN LAMP RENEWAL SHEET AS SENT TO MAINTENANCE DEPARTMENT

MAINTENANCE RECORD FORM FOR ARC LAMPS

Month	Number of lamps installed	Kilowatt-hours per month	Number of carbons used	Number of globes used	Material			Labor				Total maintenance cost	Maintenance cost per kilowatt-hour	Maintenance cost per month per 1000 sq.ft. for satisfactory intensity	Maintenance cost per lamp per month
					Cost of carbons	Cost of globes	Cost of other renewals	Cost of globe washing	Cost of lamp trimming	Cost of repairs	Indirect charges				

FIG. 4. FORM FOR RECORDING ARC LAMP MAINTENANCE

Each man in the repair department turns in his time charged to the work on the particular type of lamp in question. The summation of these items, on a chart, as shown in Fig. 4, at the end of each month, shows in detail and with accuracy the total maintenance chargeable to the arc-lamp system.

Tungsten Lamps—As previously stated, all renewals are totaled at the end of the month from the daily inspection report sheets. The labor items for renewing lamps or for removing and washing reflectors, are recorded on the daily time cards of each man and summed up monthly on a chart, as shown in Fig. 5. This chart, as in the case of the one used for arc lamps, indicates from month to month in an accurate way the total maintenance chargeable to the tungsten systems.

Cooper-Hewitt Lamps—As shown in Fig. 6, the most important items in the upkeep of this type of lamp are the renewal of tubes and repairs. A successful method of keeping track of the renewals is to place an index number on the outer case of each lamp. A sheet in a blank book is then devoted to each lamp with the number corresponding to the individual lamps in service.

When a tube is placed in use, its serial number and the date are recorded on the sheet corresponding to the lamp with which it is to be used, and when burned out or broken, the date is recorded and the serial number of the new tube placed on the proper sheet in a similar manner. The recording of these renewals, as well as of all repairs and in-

cident labor at the end of each month on the chart, Fig. 6, serves to show the upkeep chargeable to this type of lamp.

The Simplicity of the System

The foregoing items relating to the arc, tungsten and Cooper-Hewitt lamps will be applicable in principle to all lamps, and hence the detailed description of the two or three types will illustrate the general method without further explanation.

The scheme of recording maintenance as just outlined, is extremely simple, does not call for expert knowledge, and may be employed to advantage in every shop. From the standpoint of the operating man, it is well to know from time to time how these expense items compare with previous months, or with the experience in other shops. To the shop owner contemplating a new lighting system, these data are invaluable in serving to indicate what actual operating and maintenance costs amount to for various lamp types in existing shop-lighting installations.

Added to the foregoing clerical items, system in the stockrooms is an essential accompaniment to careful maintenance. Fig. 1 shows the storeroom where the various types of lamps and reflectors are kept in orderly fashion. This care in the details of the lighting upkeep has resulted in well maintained and satisfactory shop-lighting service.

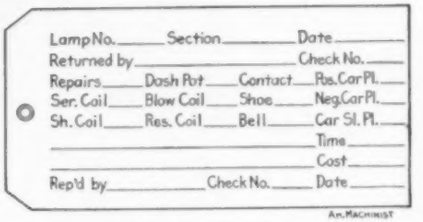

Lamp No. Section Date
Returned by Check No.
Repairs Dash Pot Contact Res. Car Pl.
Ser. Coil Blow Coil Shoe Neg. Car Pl.
Sh. Coil Res. Coil Bell Car Sl. Pl.
Time
Cost
Rep'd by Check No. Date
Am. Machinist

FIG. 3. TAG FOR RECORDING REPAIR PARTS OF ARC LAMPS

Conclusions

There is a noticeable lack of care in the segregation of costs chargeable to shop-lighting systems, due no doubt to the tendency to combine these expense items with the total shop maintenance. This is also probably due in many cases to the difficulty of separating labor charges where men are employed to take care of the upkeep of lamps jointly with other work.

In larger shops, however, it is necessary to maintain a separate department for looking after the lighting equipment, and in these cases there is no reason why some method should not be employed to determine the actual cost of every system of lighting in service. The absence of such a method often leads shop owners to wrong conclusions regarding the cost of artificial illumination, and when new equipment is required they are at a loss to determine intelligently the relative merits of the various systems.

It is well, however, to keep in mind the balance between cost and value of light. Results secured from the adoption of a recording system, as just described, must be interpreted with judgment. The light best adapted to the various shop locations, and capable of increasing the output, is in point of fact the cheapest at almost any cost, and more attention should be directed to effectiveness in illumination results than to mere difference in cost.

When, however, the lighting system has been in service for a long period, and the upkeep is found to be excessive in comparison with former years, this very increase in maintenance, due, perhaps, to deterioration of lamp mechanism, should be a guide in the consideration of a need for new apparatus.

It is hoped that the suggestions, as outlined, will aid those who are responsible for artificial shop-lighting systems in systematically recording all upkeep items. Data of this kind are far more reliable than generalized statements based on assumed constants, and with facts of this kind at hand, much unnecessary controversy regarding lighting costs will obviously give way to intelligent conclusions, based on the certainty of actual experience.

Maintenance Record Form for Tungsten Lamps

Month	Number of lamps installed	Kilowatt-hours per month	Number of lamps burned out	Number of lamps blackened	Number of lamps missing	Total renewals, all sizes	Material		Labor			Total maintenance cost	Maintenance cost per kilowatt-hour	Maintenance cost per month per 1000 sq.ft. for satisfactory intensity	Maintenance cost per (100 watt) lamp per month
							Cost of lamp renewing	Cost of broken reflectors	Renewal of lamps and reflectors, cost	Reflector washing cost	Indirect charges				

FIG. 5. FORM FOR RECORDING TUNGSTEN LAMP MAINTENANCE

Maintenance Record Form for Cooper-Hewitt Lamps

Month	Number of lamps installed	Kilowatt-hours per month	Number of tubes renewed	Material		Labor				Total maintenance cost	Maintenance cost per kilowatt-hour	Maintenance cost per month per 1000 sq.ft. for satisfactory intensity	Maintenance cost per lamp per month
				Cost of renewals	Cost of all other renewal parts	Lamp renewing cost	Lamp repairing cost	Lamp cleaning cost	Indirect charges				

FIG. 6. FORM FOR RECORDING COOPER-HEWITT LAMP MAINTENANCE

The friction losses on rolling mills are so variant, states Harold Wheatley in the *Engineering Magazine*, that the power constants derived from experiments on actual mills are not true indexes of the power required per unit of displacement actually to reduce the metal, although they may serve fairly well as guides in the selection of suitable mill drives. If the crushing strength of hot steel for different temperatures and compositions were determined by experiment in terms of the power required per cubic inch or other unit for its displacement, the values obtained would serve as a basis for the accurate determination of friction losses, the horsepower of mill drives, give opportunities for efficiency comparisons, and in various other ways be of use to the mill man and designer.

Tools for Electric Railway Repairs

By C. A. Tupper

An outline of the scope of repair work in maintaining an electric railway. Some of the tools required.

While everyone is aware that the maintenance of an electric railway now requires a great deal of shop work and outside repairs, renewals, etc., of a mechanical nature, there is probably no general realization of the extent to which this is carried nor of the number of different tools used by a modern traction system. Every road must provide for the upkeep of at least the following:

Equipment to Be Provided For

Rails, bonds, switches, crossings, frogs and other special track work, as well as any bridges or culverts used exclusively in the company's service. Trolley and feeder lines, supports and material. Car trucks and wheels, bodies, motors, controllers, brake equipments and interior fittings.

Most roads have, in addition:

Power-plant and substation apparatus and accessories. Iron or steel towers or poles, or both. Work cars with lifting cranes, etc. Sweepers and snowplows, sprinklers, etc. Auto-repair wagons.

Many provide:

Signaling and interlocking systems. Quarry equipment. Rock-crushing and screening plant. Concrete mixers. Sand and gravel screening and loading apparatus. Sand driers. Roadbed rollers. Impregnating cylinders and pressure machinery for preserving ties and other timber.

All of these have to be kept in condition, and time is often an important element.

For track maintenance a rail drill and some type of portable rail and bond welder, whether oxyacetylene, oxhydric, thermit or electric, are practically indispensable, and all progressive roads now use a traveling track grinder. On some lines a portable rail bender will also be found in service.

For erecting steel transmission-line towers and heavy iron or steel poles, electric drills and riveters are essential. They are also likely to be required in repair work at any time. The same is also true of line supports and connections, although small hand tools are usually used for these.

In the power plant and substations a portable machine which has recently grown in favor is a small motor-driven air compressor, mounted on a hand truck, for blowing dirt out of the machinery. This can also be used for cleaning purposes in the barns and car pits.

For bridge and culvert work, the ordinary structural erector's tools will be applied. Everything else, including the trucks and car bodies, with all that they carry, will be cared for directly at one of the barns or repair shops.

Repairing Equipment

The repair plant of a typical city and suburban railway or interurban line will profitably include a blacksmith and sheet-metal shop, machine shop, woodworking and paint shop, and an electric department, with the usual units of equipment found in such shops.

Shop Layout to Facilitate Work

A convenient arrangement for repair work is to have the several shops in line with each other, under one roof, and also in line with the car pits. Thus, with partitions eliminated, the entire area may be served by a set of traveling cranes and hoists.

For driving the machines, some direct-connected or individually geared or belted motors are ordinarily found desirable; but the belt drive from short lines of shafting is usually economical for the greater number, as the tools are operated more or less intermittently.

Direct-current motors, which may be constant or variable speed as required, can be operated on the railway circuit, or alternating current for induction motors taken through transformers from the power-transmission lines, if that character of current is generated. The former custom is most general.

The car house and pits are best constructed on a system of standard units; so as to permit any desired interchange of work. The complete overhauling of a car consists of removing the trucks and motors (see Figs. 1 and 2), dismantling the brake rigging, cleaning and repairing the motors, compressor (if air brake is used), resistances, controllers and other apparatus, rebabbitting bearings and thoroughly cleaning and inspecting the car from top to bottom. Other rolling stock is similarly treated.

Fig. 1 also shows a convenient C-shaped frame for hoisting and loading into cars or similar places.

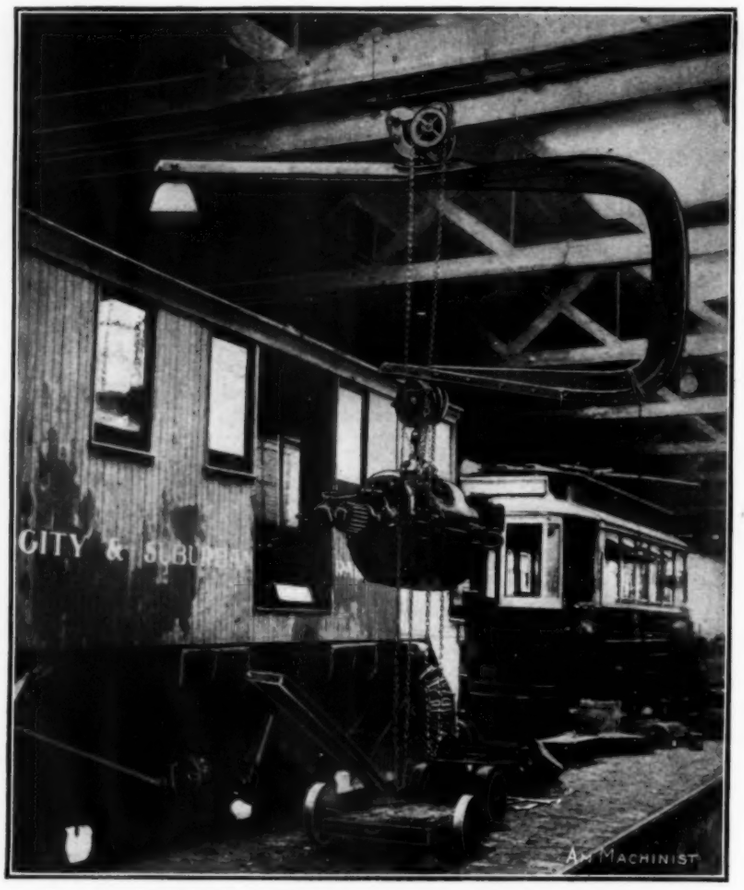


Fig. 1. Yale & Towne Chain Hoist on Special Swinging Crane Arm

The brake rigging is sent to the blacksmith shop to have the worn holes plugged and redrilled, and is replaced by a new or repaired set of rods and levers taken from stock.

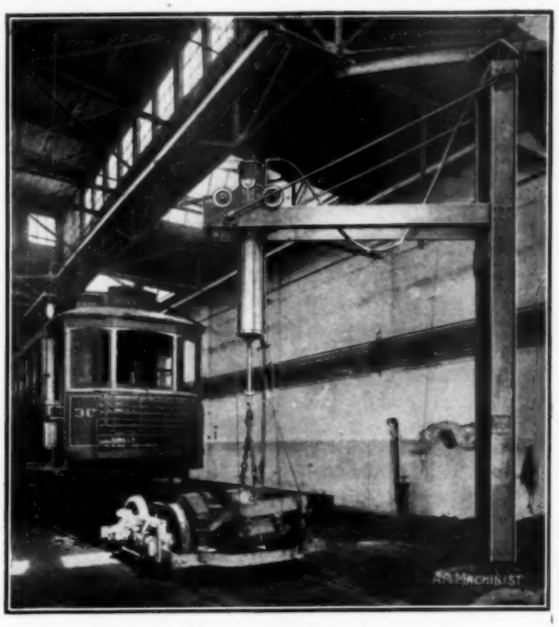


FIG. 2. LIFTING OUT A CAR MOTOR WITH A PNEUMATIC HOIST MADE BY THE QUINCY-MANCHESTER-SAWYER CO.

Defective or charred coils are removed from the main or compressor motors and replaced by coils in good condition, while the armature commutators are turned and slotted if worn. Grooving or slotting commutators is now recognized as an important element of electric-railway maintenance. It reduces injurious sparking and eliminates much of the wear by permitting the use of softer carbon brushes.

Ordinary overhauling means inspection of the trucks, wheels, journals, foundation brake gear and other apparatus under the car, also the motor commutators, armature clearances, gear lubrication, motor bearings, controllers, trolley base, etc.

FIG. 4. THE JORDAN COMMUTATOR-TRUING DEVICE

In making motor repairs the armature buggy and pinion puller are very handy devices, enabling the parts most liable to injury from rough handling to be carried about and worked upon with ease and dispatch.

There is also a variety of jacks, lifts, transfers, etc., for both regular and emergency service, greatly facilitating repairs. Any part can be removed, sent to the shop and put in condition or quickly replaced.

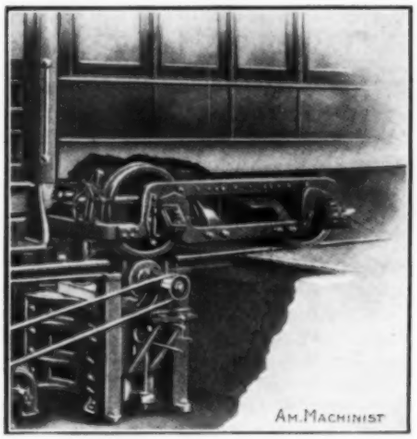


FIG. 3. THE Q. M. S. CAR-WHEEL GRINDER

REPAIRING WITHOUT DISMANTLING

The tendency is to do more and more repair work without dismantling. As an illustration of this it may be mentioned that a machine, Fig. 3, has been designed for grinding cast-iron wheels to remove flat spots without removing the truck from the cars. This wheel grinder, which is placed in the car pit, consists of two abrasive wheels mounted on separately driven arbors. The wheels have vertical and lateral movement on slides carried in a heavy cast-iron frame. A short piece of the rail over each grinding wheel is removable.

To grind a pair of car wheels the car is run over the pit and the axle of the wheels to be ground raised by two jacks. A motor rheostat is inserted in the car-motor circuit and the wheels are revolved at a speed of about 75 r.p.m. in a direction opposite to that of the twin grinder which is also motor driven so as to give a wheel speed of about 5000 ft. per minute. Wheels can be ground four or five times before the chill wears through, and each operation takes about 20 minutes.

Another type of grinder, already briefly referred to, has come widely into use. Corrugations in rails are very frequent, as a result of the severe conditions of modern traction service, and unless removed they cause a great deal of trouble. For eliminating them many roads now use a traveling track grinder, which is either attached to a car or separately propelled and driven by a motor. It

consists, essentially, of a holder with blocks of carborundum held down on the rail. Welded rail joints are also ground by a similar device.

The increasing use of solid manganese for switches, mates, frogs, crossings and other track work of a special character, has reduced wear and made it unnecessary for any but the largest roads to maintain a shop division especially for this class of material. The general shops mentioned are amply able to take care of the tools, make temporary plates, key in new centers, bend rails to curves, make split switches, etc.

Another feature of shop work often attempted is the production of offset or compromise joints. This, however, should be discouraged, as it is not practicable in an ordinary repair shop to make, for rails, compromise plates that show good results in service. Most such "home-made" offset plates ruin the rail-ends before half the life of the rail has been obtained. The best managed roads avoid any but the most temporary jobs of this character, and a new joint is obtained as soon as possible from some concern that makes a specialty of such work.

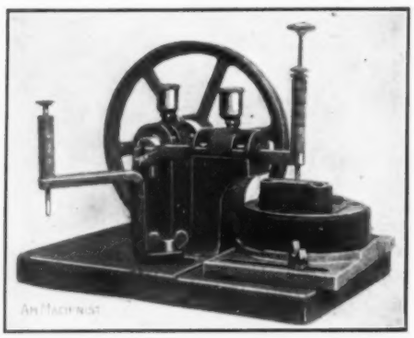


FIG. 5. THE DENTON MACHINE FOR GRINDING MOTORMAN'S BRAKE AND TRIPLE VALVES

The policy of preparing hardened-steel centers in electric-railway shops or of fabricating any special track material that can be obtained from the regular supply houses is questionable; nor should equipment firms encourage traction managers to go beyond the limits, in fitting up their shops, of necessary repair and maintenance work. When they enter upon the *manufacture* of any part of the material used by them, they are ordinarily overstepping the bounds of economy. The stock supplies and specialties enumerated usually can be obtained from manufacturers at lower prices and with better wearing results.

THE SCOPE OF REPAIR WORK

The scope of the work to be cared for in the average company's shops is very extensive in any case, as will be seen from even the most cursory survey of the list given at the beginning of this article. Consider the power-plant equipment. This, if steam is used for the prime movers, includes coal and ash elevators, conveyors, etc., furnaces, grates, stokers, pumps, feed-water heaters and regulators, economizers, dampers and controllers, cleaners, boilers, engines or turbines, condensers, gages and meters, generators and other electrical apparatus, piping for steam, exhaust, air, oil and gas, fittings, valves, lagging, etc. Keeping all these in good operating condition means considerable shop work of an endless variety during the year.

Then there is the special rolling stock. A motor car with heavy lifting crane, used both in the yards and for outside service, is now practically indispensable. Usually it will be found provided with clam-shell buckets for handling sand, gravel, crushed rock and sometimes coal. Often, too, there is a power shovel for sand pits. These machines, with the sweepers, snow-plows, sprinklers, etc., are subject to heavy wear, necessitating frequent repairs.

MANUFACTURERS' OPPORTUNITIES

The scope of such work for entire systems has, in fact, reached such proportions that electric-railway companies now annually require a relatively large quantity of shop equipment and supplies, with a steadily rising percentage of the total demand. The field is, therefore, worth studying and cultivating. At present the best opportunities for manufacturers seem to be in offerings of combination tools adapted to service of considerable variety.

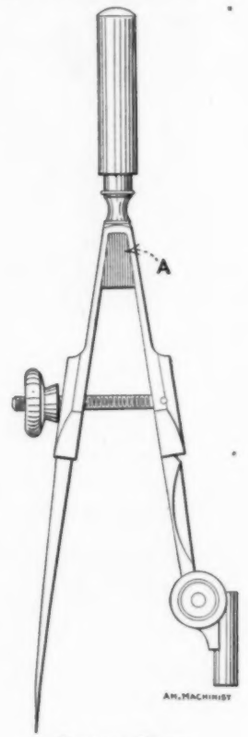
The accompanying Fig. 4 shows the Jordan commutator truing device in use on a large generator commutator. This is a convenient tool, very simple in its operation.

Fig. 5 shows a Denton grinder, which will grind any type of engineer's brake valve in use. The faceplate or chuck is counterbored to secure the various types of valves directly under the moving piston. The piston is fitted with a vertical spring plunger directly over the center of the valve. The lower part of the plunger engages in a small shoe, which is attached to the sliding part of the valve to give the required motion when the machine is in operation. By means of nuts on top of the plunger the pressure on the valve can be adjusted as desired. In using the machine for grinding a rotary valve, an extra arm is used with a stationary spring plunger for regulating the pressure on the valve. The valve is placed to one side and by means of a sliding shoe the reciprocating motion of the piston is converted into a rotary one for the valve. The plunger on the piston must be raised by the locknuts and clamped there to avoid pressure on the valve. All the downward pressure for grinding this type of valve is supplied by the stationary plunger. The machine is compact in design, can be placed on a bench in the valve department and may be driven by using a small, round belt connected to the line shaft. Only a fraction of a horsepower is required for operation.

Spring Bows

BY J. DITCHFIELD

Most draftsmen know that it is more convenient to draw small circles with spring bows than with bow compasses. But most spring bows lose a certain amount of their spring after long usage and will not open to their full width. If a piece of hard rubber *A* is inserted a tight fit between the legs as shown, this trouble will be eliminated and will take some of the strain off the legs.



SPRING BOWS

In the past five years the Pennsylvania R.R. has enlarged its fire-fighting system, and has so improved its methods of inspection that company employees now extinguish many fires which formerly would have gained headway and caused losses. In 1907 company employees extinguished 195 fires; in 1908, 274; in 1909, 321; while 1910 and 1911 showed equal increases in the efficiency of the company's fire-fighting system. Locomotives in yards, equipped with special apparatus for use in case of fire, were instrumental in extinguishing 43 fires last year.

Jigs for Newspaper Folding Machine

By F. A. Stanley

Some tools of simple design used effectively in an Omaha shop for drilling brackets, side plates, uprights and other members of a machine for folding and trimming newspapers as they come from the press.

The product of the Omaha Folding Machine Co., Omaha, Neb., is a folder and trimmer for handling newspapers of from 4 to 12 pages, printed on drum-cylinder presses of various makes and sizes. It is built up with a light, but stiff frame of steel angles, to which are attached suitable brackets and boxes for carrying the shafts, rolls and other mechanism. After it is once adjusted to the printing press the folder may be quickly attached to the press for operation or removed and drawn out of the way in a very few moments.

The parts which make up this folder are of simple nature. The jigs and fixtures used in machining them are arranged to accomplish their work satisfactorily without complication of design or expensive features of construction. Several jigs of this character are illustrated.

A Double-purpose Jig

The jig at *A*, Fig. 1, is for drilling a small bracket which carries a knife arm. The jig is a double tool with means for holding the casting in two positions for the operations of drilling the base and the lugs.

The first operation consists in locating the work upon its base at the right end of the jig, where it is secured by a thumb-screw and by a projection on the jig which fits between the lugs on the work. The two holes are drilled in the base and the piece is then transferred to the other end of the jig and located in a vertical position over two pins which fit the drilled holes. The clamp-screw at this end of the jig holds the work against outward movement due to the thrust of the drill in putting the hole through the lugs.

Another Bracket Jig

The jig shown at *B*, Fig. 1, is for another bracket with lugs at both sides and at one end of the body. The bushings for the side lug drills are fitted in the side walls of the jig and the bush for drilling the end lug is carried in the lid. The drill for the side lugs is further guided by a pair of bushings carried in supplementary walls inside the jig proper.

The work drops into an opening formed behind these inner walls and rests with its end lug upon a stiff vertical web which ties the two sides of the jig casting together. The thumb-screw in the lid presses the work against the front face of this web when the jig is closed, and this holds the casting for the drilling operation.

The brackets are made right- and left-hand as shown, the base of one casting being cut away on the left side, the other on the right. The hole in the base of each bracket is slightly off center so two bushings are provided in the front of the jig, one for each bracket hole.

Drilling Boxes for Main Shaft

A jig is shown at *C*, Fig. 2, for drilling the seats in the sides of the self-aligning boxes to receive the cone points of the trunnion screws upon which the boxes are adapted to swivel when in operation. These boxes carry the main shaft in the folding machine and are finished internally and faced on the ends before they are placed in the drill jig referred to.

This jig, like the one represented at *A*, Fig. 1, is so constructed as to relocate the work for the second drilling operation from the hole drilled at the first setting.

Two boxes in position for the two operations are seen in place in the jig *C*. The work is first placed on the stud at the right with one of its trunnions between the locating jaws under the bushing plate. The conical seat in this trunnion is then drilled and reamed to the angular form required, and the box removed and slipped over the other stud where it is located by a cone-pointed screw which has a large head to permit the operator to adjust it readily into the conical seat already drilled. This holds the box correctly for the forming of the seat in the opposite trunnion.

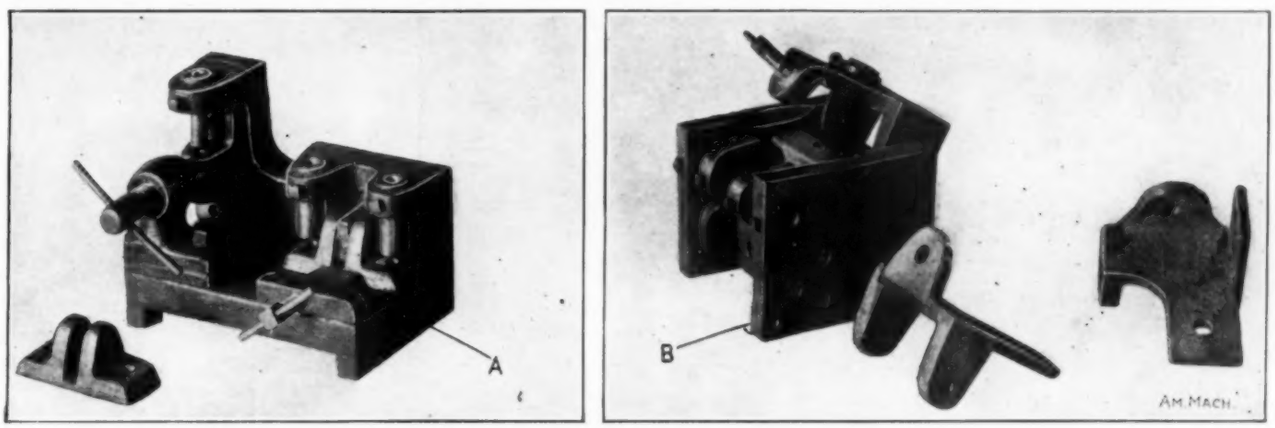


Fig. 1. Two Bracket-drilling Jigs

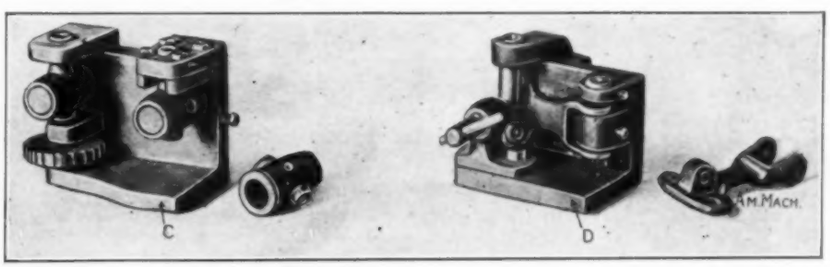


Fig. 2. Jigs for a Box and Bracket

Drilling a Pulley Carrier

The jig illustrated at *D*, Fig. 2, is for drilling the holes through the forks and the thick lug of the casting seen at the right of the jig. This bracket is used in the folding machine for supporting a small wood pulley for carrying a tape. There are two holes in the flat ears at the sides of the bracket, but these are cored in the foundry and so do not require drilling in the jig. In fact they are placed over two pins in the jig which serve as the locating devices for the work.

The method of holding the bracket in the jig requires little explanation. It may be stated, however, that the admission and removal of the work is facilitated by the means adopted for carrying the long bushing at the left side of the jig. Although the illustration does not show this feature clearly, the bushing is mounted in a hinged plate which swings up to leave that end of the jig open to admit or release the work.

Right and Left Jig for Machine Legs

The right- and left-hand castings *E*, Fig. 3, are drilled in the jig *F*. The castings are two of a set of four which form the legs at the corners of the folding machine proper. The jig is a simple angular frame with a square band at each end for supporting the body and for enabling it to be handled easily. A curved plate at the left end carries the bushings through which the feet of the castings are drilled, and small angles attached to the inner faces of the jig carry the bushings for the drilling of the holes through the different arms projecting from the sides of the castings.

Three clamp plates with thumb-screws tapped through are slipped into slots in the jig walls and hold the work, whether right or left hand, in the angle of the jig.

A Plate-drilling Jig

Another jig included in the view in Fig. 3 is for drilling the plate *G*. This casting is one of a pair of side plates which carry a series of tape-wheel supports; three holes are drilled through its lower edge to admit the screws by which it is fastened to the machine frame.

A spring plunger at the right end presses the work against a stopscrew at the other end of the jig, and the handle above the work forces it against the screws in the rear, the short bent end of this handle acting in a fashion similar to an eccentric binder.

The spring plunger at the end is withdrawn to release the casting, by the lever at the right. The two shorter handles attached to the front of the jig are merely to facilitate handling of the work under the drill.

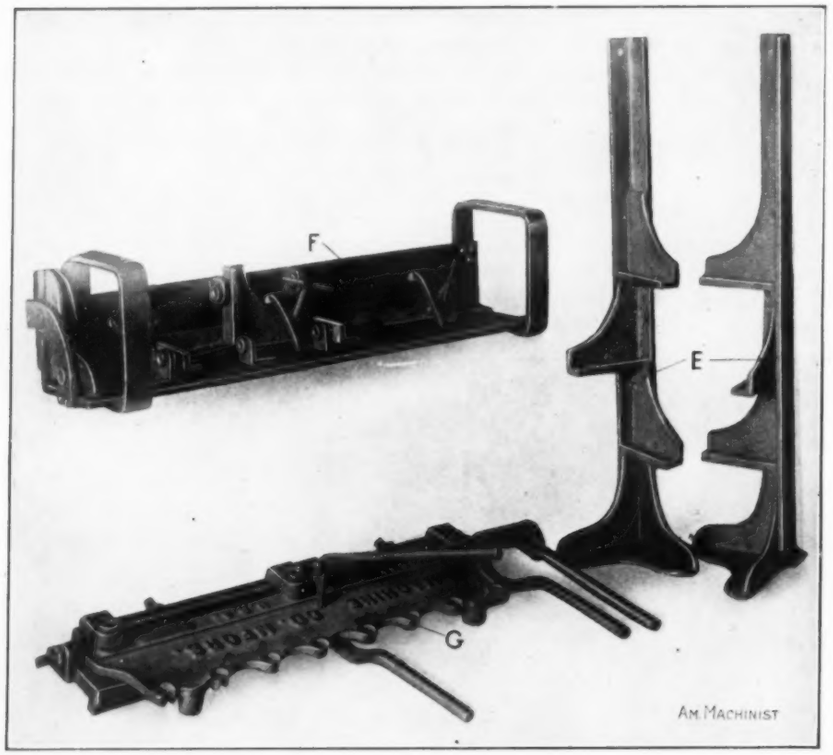


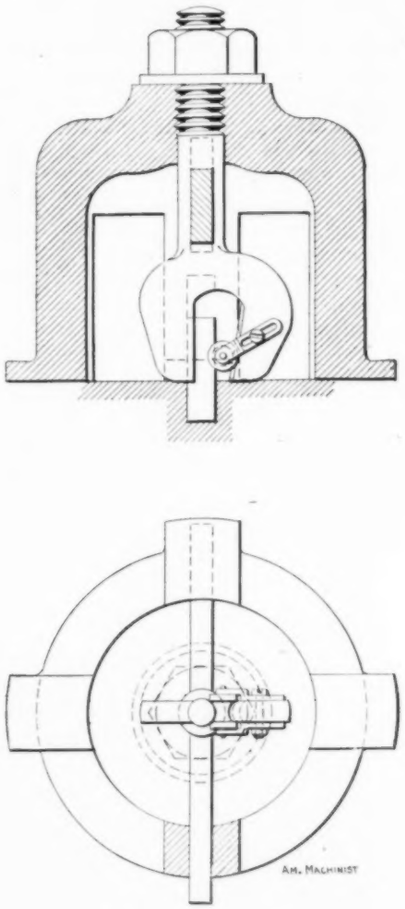
Fig. 3. Jigs for Two Uprights and for a Side Plate

It is not always the fault of the emery-wheel when a tool is burned in grinding, but quite frequently it is the fault of the man doing the work. One is apt to forget that end of the argument.

A Stud Extractor

By C. A. James

A number of plain studs, wrongly driven into constructional work, required removing, the present method being to chip off and then redrill. The rig illustrated shows how these studs were removed, the idea working on the same principle as the plate lifter.



A Stud Extractor

By grooving the side of the clamp and roller to suit the stud, tremendous power can be exerted on the stud, a rib being left on the taper side of the clamp to prevent the roller from breaking at the groove. The grooves could be serrated if studs were of no further use.

A method of demagnetizing a watch, said never to fail, is pointed out in our contemporary, *Power*. Suspend the watch by a strong cord; twist the cord so that when released the watch will spin for several seconds, release it, and while the watch is spinning slowly approach it with the positive pole of any strong magnet and then slowly withdraw the magnet. Do this a number of times and be sure that the magnet is not near the watch when it ceases to rotate or afterward.

New Factory of Bosch Magneto Co.

Special Correspondence

The Bosch Magneto Co., of New York, is just completing, in Springfield, Mass., a factory capable of accommodating 1000 employees. The general layout has been so arranged that additions to the present buildings can readily be constructed, which will permit of employing 3000 workmen.

A four-story reinforced concrete building of very pleasing exterior appearance. It will accommodate 1000 workmen.

Each floor has two working bays, some 27 ft. wide, separated by a center passageway 7 ft. wide, defined by two rows of interior columns. Wash, locker and toilet rooms are on each floor level in wings.

In installing the heating, ventilating and lighting equipment the desire has been followed to provide the best possible conditions for the workmen. Details of these installations are given.

The present plant comprises three buildings: The manufacturing building, the power house and the boiler house. Besides there are a number of smaller buildings of a temporary character. Reinforced concrete has been used as the principal material of construction. The manufacturing building has a very pleasing exterior, as can be judged by referring to Fig. 1.

The architectural details with reference to appearance have been given more attention that is usually done in factory building. The reason lies in the fact that the site fronts on one of the principal state highways or "state roads" leading westward from the city of Springfield. Thus tapestry brick have been used for the spandrel walls, while the concrete work has been painted a light buff color.

The Manufacturing Building

This is cross-shaped in plan, as shown by Fig. 2. The longer portion has a length of 315 ft., a width of 66 ft., and has 4 stories, each 13½ ft. high. It contains the workrooms and offices.

The front projection, or wing, contains the main stairway and a toilet room on each floor. The rear wing contains wash and locker rooms. This arrangement is plainly shown in the typical plan, Fig. 2.

Returning to Fig. 1, a room projecting above the roof is shown at the left-hand end. This houses air washing and cooling machinery, and a large blower. A similar room is located at the other end. In front, directly over the front wing, is seen another room projecting above the roof. This is a ventilating tower containing exhausters discharging to the atmosphere.

The location of the boiler and power houses is also indicated on Fig. 2. These are entirely below grade and will be at the bottom of light courts after the addition sketched in outline has been built. The boiler house contains cast-iron boilers to furnish steam for heating purposes.

The power plant, when completely installed, will consist of a 280-hp. Diesel oil engine, connected to a 200-kv.-a. generator, which will furnish current for both power and lighting. Both boiler and power house are constructed of reinforced concrete.

Turning to the main building, as already stated, the principal material of construction has been reinforced concrete. The curtain walls of the second and third floors are faced with tapestry brick, the wearing surface of the floors is wood, otherwise the shell of the building is of concrete.

An exterior feature shown in Fig. 1 is the loading platform seen at the left. A spur track connects with the main line of the Boston & Maine R.R., thus affording convenient shipping facilities. This platform is roofed over as shown to afford protection in rough weather.

In the typical floor plan, Fig. 2, it will be seen that the working areas consist of bays about 27 ft. wide with a center passageway lengthwise of the building 7 ft. wide. This passageway is defined by two rows of interior columns. This arrangement is well shown by Fig. 6, and is an unusual feature of factory design.

It is obvious that the area on each main

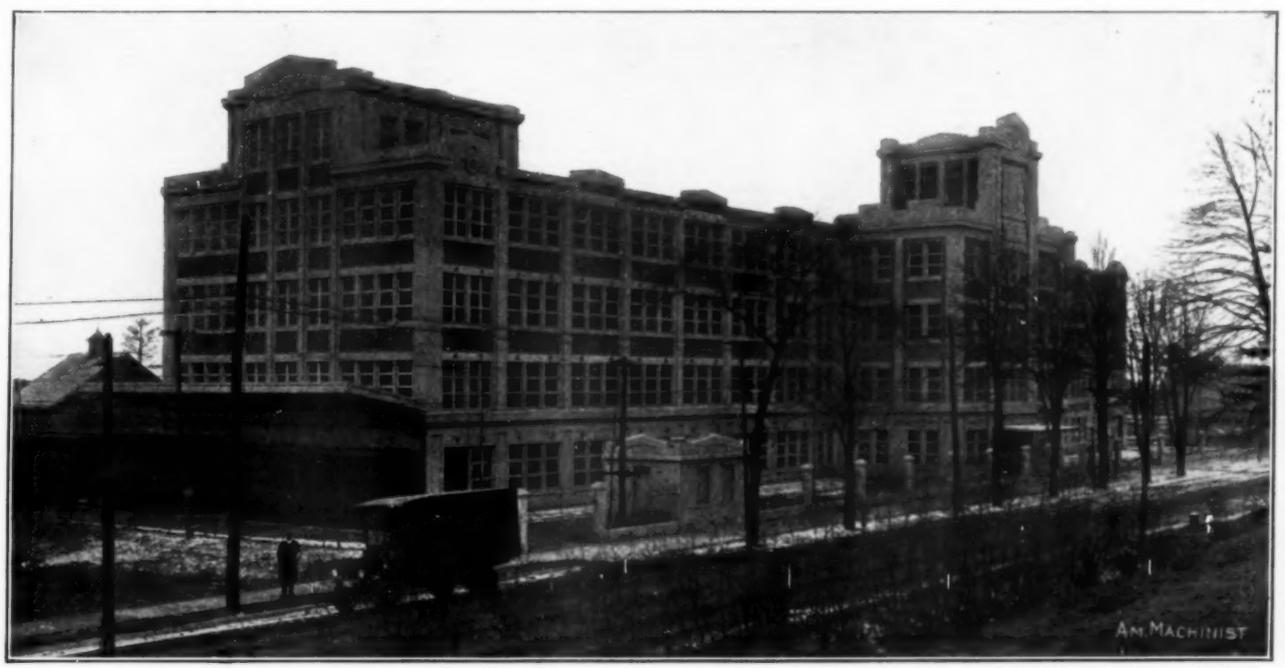


Fig. 1. New Factory of the Bosch Magneto Co.

floor between the front and rear wings is not advantageously situated to receive natural light. Appreciating this fact, departments which do not need the best light have been located in these spaces. Thus we find the floor stockroom, the hardening room, forgeroom, waiting room for workmen, and meeting room placed near the main stairway on each floor level.

Further, the partitions between the main building, the stairway in front and the rear wing are of wire glass, to allow as much light as possible to enter the center of the building.

The floors above the ground floor are of reinforced concrete, girder and beam construction, as seen in Figs. 6 and 7. The wearing floor is of 2¼-in. face maple on a wooden subfloor laid on stringers embedded in cinder concrete. All this, of course, resting on the reinforced-concrete, load-carrying underfloor.

For ordinary machinery, the holding-down screws are merely put into the wood floor. In the case of some heavy machines, it has been necessary to bore holes through the wood floor and fill the space between the cinder fill and the subfloor with grout. All floors in the wings are of reinforced concrete.

The roof is of reinforced concrete, waterproofed with five-ply tar and felt, with slag on top. This waterproofing was laid on a bed of cinders from 6 to 18 in. thick. This cinder fill not only gives the slope necessary to drain off storm water, but also serves as an excellent insulation against the cold of winter and the heat of the sun in summer.

The bottoms of all beams in the main building contain cast-iron inserts forming T-slots for the full length. These provide a convenient means for fastening shafting hangers, pipes, electric conduits, etc., to the ceiling. The section, Fig. 3, shows the type and location of this metallic T-slot.

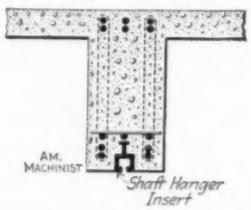


FIG. 3. SECTION OF BEAM SHOWING SLOT

The main stairs are located in the front wing, as previously mentioned, and as shown in Fig. 2. They are entirely of concrete construction with the stair landings laid with terazzo. Safety treads are used. The same construction applies to the stairs at either end of the main building, except that the landings are of concrete instead of terazzo.

Two electrically operated elevators are indicated on the plan of Fig. 2, each having a carrying capacity of 3000 lb. Further, an electric dumbwaiter with push-button control, connects the stockrooms on the upper floors with the main stockroom on the ground floor. Near the loading platform a hydraulic lift has been installed to facilitate the loading and unloading of railroad cars.

THE HEATING EQUIPMENT

It has been the desire of the owners when designing this building to provide the best possible conditions for the workmen both as regards their health and their working facilities. The following

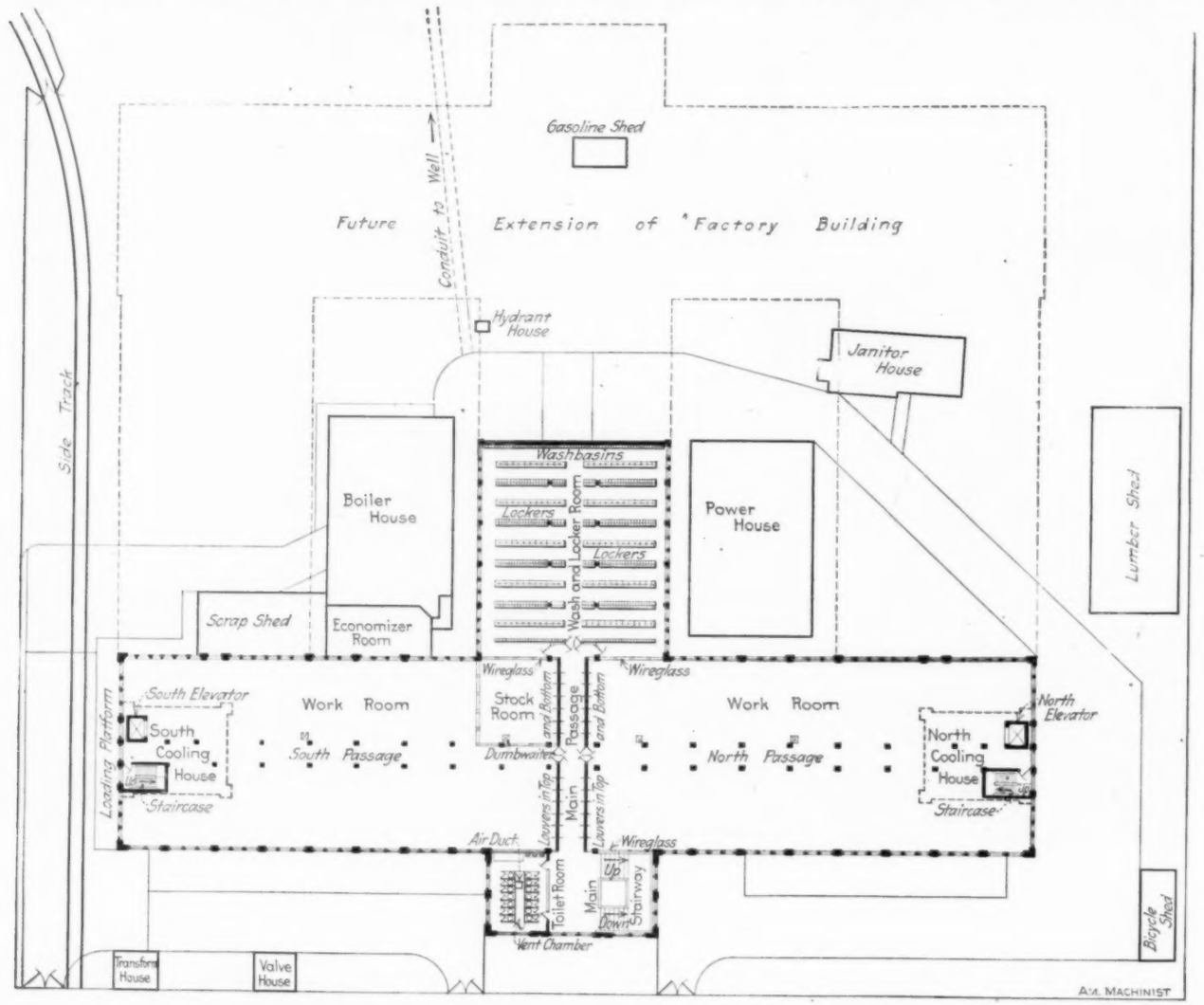


FIG. 2. OUTLINE OF PLANT AND GROUND PLAN OF BUILDING

out of this desire is no better shown than in the provisions for heating and ventilating. These are worked out with much greater attention to detail and with more provision for obtaining comfortable conditions than has been done in any other machine shop in this country, so far as our knowledge extends.

The heating system may be termed an indirect system. It uses air as the convecting medium, but differs from the ordinary system of indirect heating in that instead of one large heater through which the air is forced at high velocity, there are a large number of radiators along the outside walls over which the air travels at a comparatively slow rate. These radiators are supplied with low-pressure steam, the condensing water being returned to the boilers by gravity.

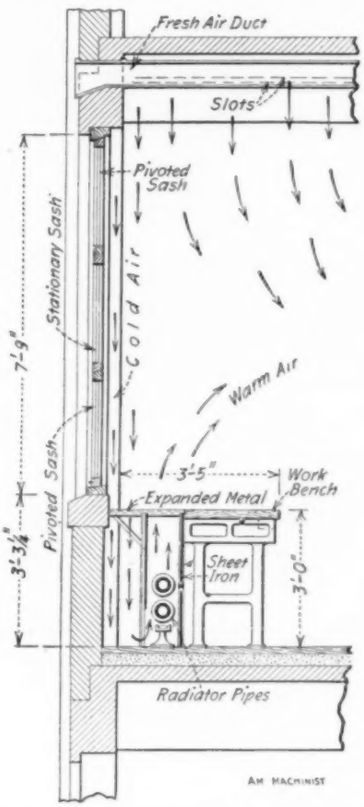


FIG. 4. ARRANGEMENT OF WINDOW, RADIATOR PIPES AND WORK BENCH

The gases of combustion from the boilers pass through economizers, where a part of their heat is taken out, and they are then led to smoke-stacks, which are within the main building. But the plant has no visible smoke-stacks, which we are wont to consider a necessity in any shop view. An inclosure 9 ft. high is carried around the smoke-stacks on each floor, in order to protect workmen from direct radiation.

The warm air coming from the economizer room is used to heat the stockroom on the first floor. This room is adjacent to the boiler house and occupies about one-fourth of the floor area. As the amount of heat furnished by the economizer is more than necessary for this stockroom, arrangements are being made to pass a portion of it to the upper floors.

The arrangement of the radiators is shown in Fig. 4. They consist of cast-iron pipes with large radiating fins to increase the heating surface. It was necessary to import these pipes from Europe, as they could not be purchased in this country.

A section through an outside wall and the work bench is shown in Fig. 4, which also shows the radiator pipes separated from the wall by a partition extending nearly to the floor. A second partition separates the pipes from the space beneath the workbench. Both of these spaces are covered over with expanded metal. When the radiator is heated, the surrounding air will rise in the inner space and will draw cold air through the space next to the wall. The cold air coming in through and around the windows drops, passes through the outer space, rises in the inner space containing the radiators, is warmed and finally leaves at the top. The natural circulation is increased by the suction from the exhaust fans, located in the main stairway tower.

This arrangement of the radiators has the advantage of minimizing the losses of heat through the walls and windows. The cold part of the wall is protected against direct radiation and the cold air that filters in around the windows forms an insulating layer in itself. Further, the work benches are not set directly against the radiators, thus the rising warm air does not reach the workmen as an unpleasant draft, and the inner wall of the casing protects him from direct radiation.

THE VENTILATING EQUIPMENT

Equipment is provided to ventilate the building by mechanical draft. The stairwells are the vertical ventilating flues, with fans at the top of each. In the ventilating tower over the main stairway are two disk fans, each having a maximum capacity of 100,000 cu.ft. of free air per minute. The discharging capacity of these two fans taken together can be varied from 50,000 to 200,000 cu.ft. per minute.

In each cooling house, located over the end stairwells, is a blower, having a capacity of 30,000 cu.ft. of free air per minute.

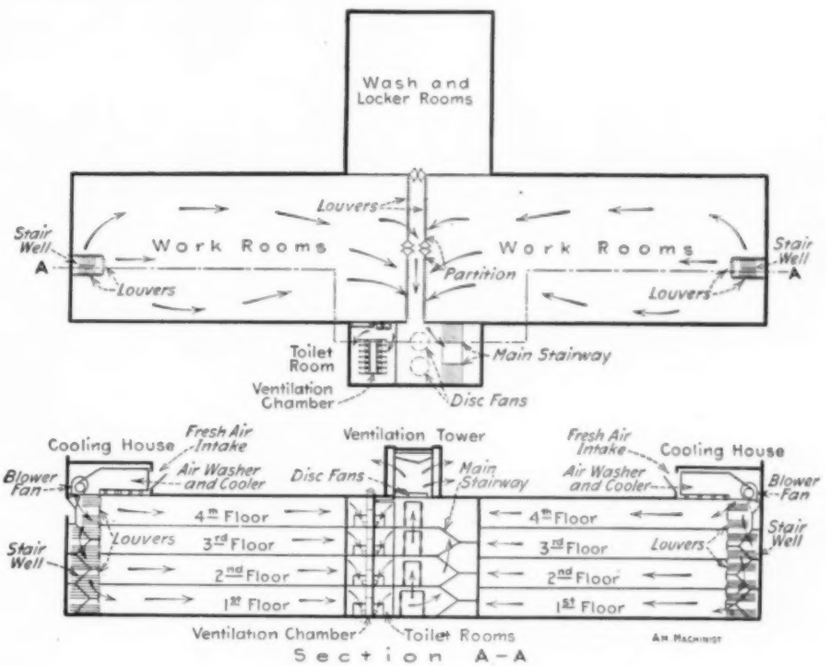


FIG. 5. DIAGRAM OF VENTILATING SYSTEM

The direction and velocity of the flow of air through the workrooms to the ventilating tower and out, are regulated by louvers, which are placed in the partitions that divide the floors of the main building. These partitions divide each floor into two parts, separated by a central cross passageway running from the front to the rear wing or from the main stairs to the wash and locker rooms. Louvers are also provided in the walls of the stairwells at the ends. Fig. 5 is a diagram of this ventilating system, showing the scheme of operation in hot weather. The operation can, of course, be varied, depending upon weather conditions.

In winter the disk fans in the main stair tower are used only to produce a change of air twice every hour. A part

of the fresh air enters around the windows. The rest is taken in through galvanized iron pipes, which run along the ceiling and through the outside walls into the open air. These pipes are 6 in. in diameter, and vary in length from 8 to 25 ft., according to their distance from the main stairwell. Cold air enters the room through a number of thin slots in these pipes, and in dropping mixes with the warm air, which is constantly rising. The temperature in the room is, therefore, kept uniform.

In producing the circulation, the air is drawn toward the center partition and escapes through the bottom louvers into the stairwell, whence it is drawn to the roof and discharged. This method of operation during cold weather has been thoroughly tested during the past winter, and in combination with the heating system, has proved very satisfactory. Although the loss of heat in the air discharged to produce the necessary ventilation is considerable, the consumption of fuel is well within the expected limit.

As the weather becomes warmer and windows can be opened, the number of changes of air per hour is gradually increased. If desired, the two blowers situated over the end stairwells can be used as exhausters in connection with the disk fans over the main stairwell. With this arrangement, it is possible to change the air 12 times an hour, and with a proper regulation of the window opening, a perceptible draft can be felt. This regulation is easily obtained, as the windows are controlled in units and cannot be opened by individual workmen.

The operation of the system in hot weather is expected to be as follows: The exhaust fans over the main stairwell will be run during the early morning hours to draw the cool night air through the building. Thus the interior will be cool in the morning when the workmen enter, and the cooling of the large masses of concrete and metallic contents of the room will aid in keeping down the temperature of the interior air during the day.

As the exterior air increases in temperature, owing to the effect of the sun, the fans will be stopped. There is obviously no advantage or relief from drawing heated outside air into the building.

When this condition has been reached, it is the intention to close all windows and bring fresh air through the two stairwells at the ends of the main building, cooling this air before it enters the workrooms. For this purpose two air-cooling machines are installed in the rooms on the roof. These machines are of the water-spray type.

Air is taken through openings into the cooling house, enters the machine, is drawn through the water spray, passes around a number of baffle plates, where it loses its free moisture, then continues through the fan into the stairwell and through louvers into the workrooms. After it has circulated through the rooms, it leaves through the upper louvers in the center partitions, is drawn into the front main stairwell and exhausted.

Water for the air-cooling machines is to be taken from a driven well on the property at the rate of 60 gal. per minute for each machine, with an entering temperature of about 54 deg. F. With this quantity and temperature of water, the manufacturer of the cooling machines guarantees that air entering at 95 deg. F. and containing 9.3 grains of moisture per cubic foot, will be cooled to 78 deg. F. Thus it is calculated that under such conditions it will be possible to keep the temperature inside of the building about 9 deg. lower than the outside temperature, changing the air four times each hour.

This is the first attempt that we know of to cool large machine-shop rooms with a view to improving working conditions during hot weather. The Bosch company is to be highly commended for this initial forward step. At this writing, the cooling machines have not been operated, so it is impossible to state what their performance is to be. However, the system as installed is so flexible that it should not be difficult to overcome any unforeseen troubles that may arise in use.

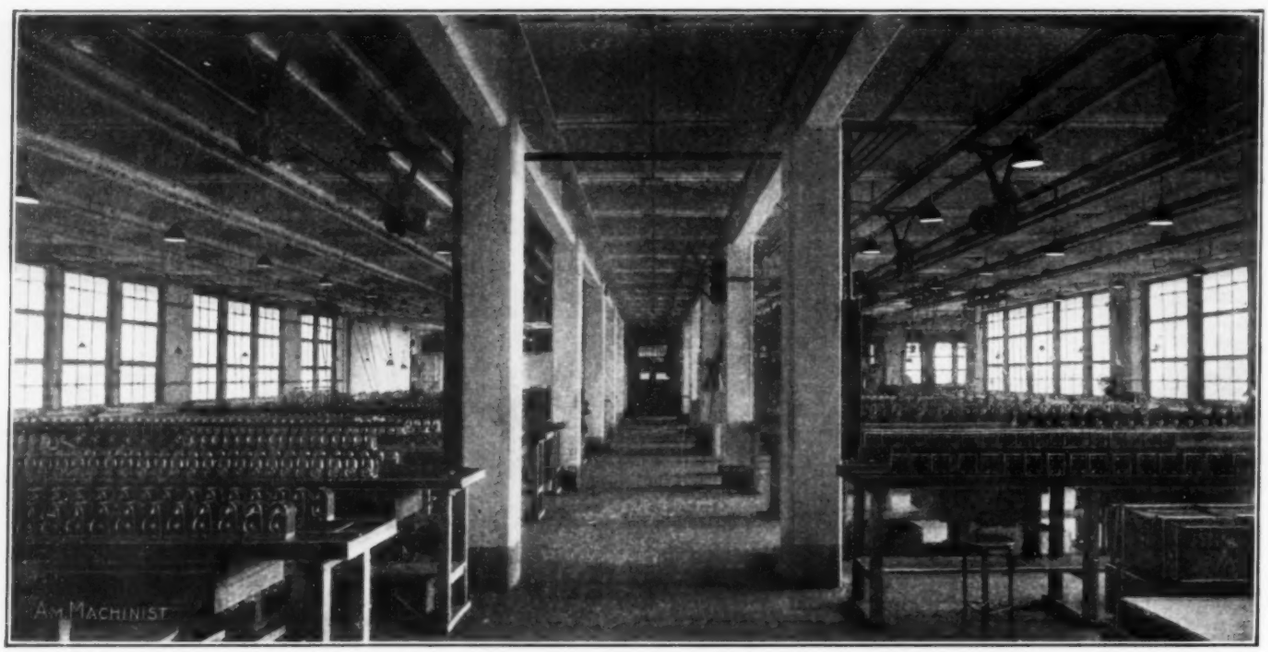


FIG. 6. ASSEMBLING DEPARTMENT, SHOWING ARRANGEMENT OF BAYS AND CEILING FIXTURE

The ventilation of the forgeroom and toilet room on the first floor and hardening room on the second floor is separated from the general ventilation to keep the fumes and gases out of the general workrooms. Two exhausters draw the air from these rooms and convey it through a chimney flue to the open air at the roof level.

WATER SUPPLY

A machine shop requires an enormous amount of water, and it is wise to have a supply from more than one source. Appreciating this fact, three independent supplies have been arranged for. An artesian well in the rear of the main building supplies water for the washrooms, toilet rooms and general purposes. Storage is provided in a tank on the roof,

which is filled by a pump located in the wellhouse and under automatic control.

Turning to the plan of Fig. 2, it will be seen that one end of the main building is on land in the city of Springfield and the balance on land in the city of Chicopee. Thus two city water supplies are available. Water from these sources is used in the drinking fountain, for the hydraulic lift on the loading platform and for fire protection. The Springfield system has a pressure of about 140 lb., the Chicopee system about 110 lb. per sq.in.

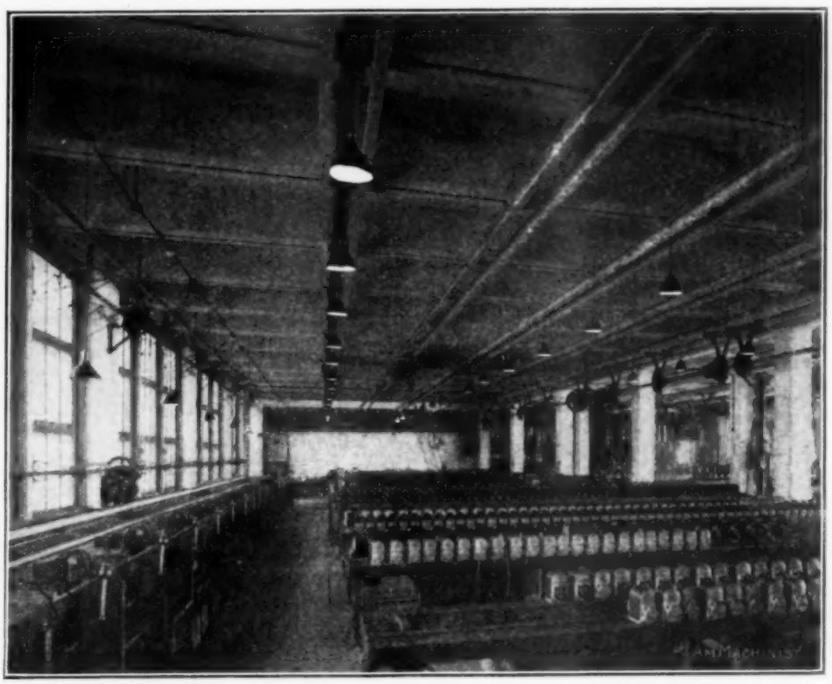


FIG. 7. ASSEMBLING DEPARTMENT, SHOWING ARRANGEMENT OF LAMPS FOR ARTIFICIAL LIGHTING

Thus either system is satisfactory for these purposes. Connection is made to the two supplies by means of two gate valves, which are so interlocked that neither can be opened until the other is closed. This arrangement was made necessary, as the water department of the city of Springfield required that provision be made to prevent any Chicopee water from reaching the Springfield main.

WASH AND TOILET-ROOM EQUIPMENT

Wash, locker and toilet rooms are on each floor, and arranged as shown by Fig. 2. The washrooms are provided with individual lockers, arranged in parallel rows with banks of individual washbowls between. The latter are to be supplied with hot water from the cylinder jackets of the Diesel engine in the power house. This hot water is to be pumped into a tank on the fourth floor, from which it is distributed.

A well worked-out system of ventilation is provided for the toilet-room utilities. Referring to Fig. 2, the space between the two banks of stools is indicated as a ventilating chamber. This space is entirely inclosed by partition walls and contains the flushing valves and waste and water piping. Further, each water closet is provided with a local vent, having an area of about 12 sq.in., and opening directly into this ventilating chamber. The four ventilating chambers, one on each floor, are connected by a flue, which leads directly to the exhaust fan at the top of the main stairwell. Thus the toilet rooms are ventilated through the local vents of the water closets, which is undoubtedly the most effective toilet-room ventilation that can be devised.

Heat and fresh air in winter are supplied by a duct, which leads warmed air from one of the stockrooms on the ground floor, which is not connected with the general ventilation system, as previously mentioned. In summer, fresh air enters through the open windows.

SYSTEM OF NATURAL AND ARTIFICIAL LIGHTING

The arrangement of windows in the side walls can be seen by referring to Fig. 1. Additional light is provided for the fourth floor by six skylights. Each side window has three wooden sashes, the top and bottom pivoted, the center stationary; see Fig. 4. The pivoted sashes are fitted with weather strips to insure tightness, and are operated by a worm-and-gear device, which moves from 12 to 20 sashes at once. All windows are double-glazed, to provide insulation against cold and heat.

The artificial illumination is mostly from 60-watt tungsten lamps. In the offices they are fitted with intensive holophane glass shades, and in the shop with white porcelain enameled steel shades. The type used in the shop is shown in Figs. 6 and 7.

The general scheme is a combination of individual lighting and general lighting. This is shown in Fig. 7, where a row of lamps is run over the side bench, and three rows over the cross assembling benches. Individual lights over the benches are mounted on adjustable fixtures and provided with side-holder steel shades. As a rule, these lamps for individual lighting are 40-watt each. They are installed in connection with a sufficient number of other lamps to provide satisfactory general illumination. Lamps which require handling are carbon filament, while the others are of the tungsten drawn-wire type.

The intensity of the general illumination on the desks and tables in the offices is, on the average, 4.2 foot-candles. The same factor for the shop is 3.9 foot-candles.

THE SYSTEM OF POWER

Throughout, the machines are arranged for group drives. The main line shafts are about 60 ft. long, each being driven by an induction motor of 10, 15 or 20 hp., as requirements demand. The current is two-phase, 60-cycle, 440 volts. It is transmitted by means of a four-wire system.

Awaiting the completion of the power plant, current is being taken from the city service; the transformation is done outside of the main building by oil transformers. From this point current is carried through underground conduits of the main building into the power house, where it reaches the central switchboard for distribution.

From this central switchboard five power feeders and ten lighting feeders conduct the current to the various departments. An independent emergency feeder, which can be connected to any of the four supplies in case of a breakdown of a regular feeder, is run parallel with all power feeders. Special care has been taken to arrange a system of power wiring, so that the supply of current will not be interrupted for any length of time by disturbance in the supply line. For this reason, fuses are avoided as far as possible and circuit breakers installed, for the protection of motors and the circuits themselves.

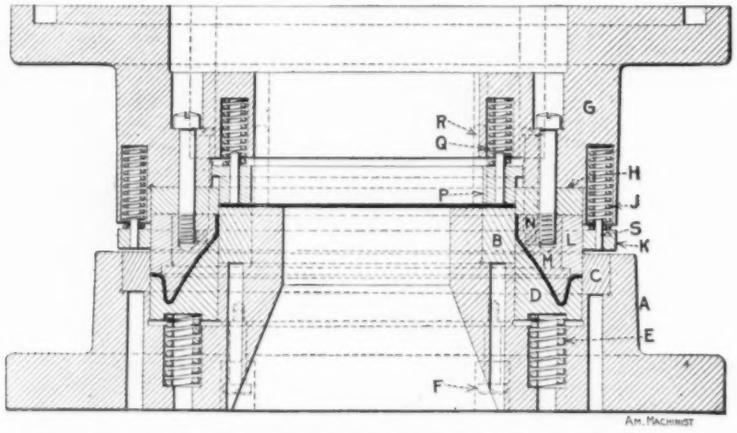
In the power house two transformers, each of 30 kw. capacity, transform the current to 110 volts for the lighting circuits. The devices and arrangements for supporting main line shafting, piping for various purposes and for electric lamps are shown in Figs. 6 and 7. The details are so plain as to make description unnecessary.

Piercing and Trimming Die for a Searchlight Front Reflector

By Aron Lawrence

The production of sheet-metal reflectors for searchlights is usually accomplished by spinning them from circular disks of sheet metal in an ordinary spinning lathe, but where the quantity required is sufficiently large to warrant the investment, press tools may be used advantageously to accomplish the same result. The die under discussion is one of a series designed to produce a parabolic reflector in very large quantities.

The blanking and drawing operations are accomplished in the usual manner by proper dies, but the piercing out of the center of the drawn part and the trimming of its exterior presented some difficulties, which, however, were satisfactorily overcome by the die shown.



Piercing and Trimming Die for Searchlight Front Reflector

Before describing the dies under consideration, one or two pertinent points regarding the piece being produced should be noted.

On account of the use to which the work is put, it is obvious that a perfectly smooth and accurate parabolic surface is essential in the finished product, as otherwise, after the reflector is polished, silver plated and buffed, it will not be a true reflector, and will show black spots in the light beams. In view of this fact, care must be taken not to mutilate the reflector surface in any way during its production.

During the first operations, the sloping or parabola portion of the reflector is drawn straight, the true parabolic shape being obtained in the last operation by "ironing" over a hardened-steel parabola form, which will be mentioned later on in describing the die.

Referring to the cut, the die shoe *A* is a circular iron casting with a flange at its lower portion, by means of which it may be bolted to the bolster plate of the punch press, or, if desired, held down by toe clamps. This casting is bored out, as shown in the sectional view, to receive a hardened tool-steel trimming-die ring *C*, which is pressed into place. It also carries about its central portion a punch ring of hardened tool steel *B*, which serves to pierce out the center of the reflector.

Several holes are drilled through *A*, in order that these two rings may be driven out later, if desired, by means of drift rods. Sliding vertically around the ring *B*, and within the ring *C*, is the forming band *D*, which is of steel, although not hardened, as there is no great wear on it. This band is spring-pressed upward by a plurality of helical springs, pocketed in suitable counterbores in the casting *A*, and has its travel limited by the shouldered studs *F*, the heads of which slide in suitable counterbores.

The upper portion of the die comprises a cast-iron holder *G*, which is attached to the pressed ram, and centralized by the circular groove on its upper surface, which fits over a mating ring on the press ram. The lower portion of *G* is bored out to receive a die ring *H* of hardened tool steel, which is held in place by several fillister-head screws passing through it and entering the male forming band *M*, which is of steel, but unhardened. A projecting flange at the lower exterior portion *M* engages a similar flange on the trimming punch *L*, which is of hardened tool steel.

It will be seen that one set of screws thus serves to interlock and attach three pieces to the lower surface of *G*. It will also be appreciated that this construction enables the three rings to be disassembled in order to grind the lower faces of *L* and *H*, respectively, when sharpening becomes necessary. Sliding within *H* is a soft-steel stripper ring *P*, which has its travel limited by its upper flange portion coming to rest on top of *H*. This ring is spring-pressed downward by the helical springs *Q*, and is prevented from twisting the guide pins *R*, which project upward into *G*.

Encircling the ring *L* is a soft-steel stripper ring *K*, which is spring-pressed downward by the helical springs *J*. Shouldered studs sliding in *G*, and attached to *K*, as shown at *N*, limit the downward travel of the stripper ring.

When the die is open with the press ram up, the reflector is placed in position over the central portion of the die, at which time the forming band *D* will be at the top of its stroke, and will approximately fit the sloping side of the reflector. As the upper member descends, the parabola will be "ironed" into a reflector, after which the central portion will be pierced out and the exterior trimmed, as is shown which represents the die completely closed and with the ram way down.

On the upstroke of the press, the center scrap and the trimmed scrap will be released, leaving the reflector resting loosely in the die, from which it is readily removed by the operator. This tool was operated in a large-size Bliss press. By varying the upper portion of *G*, it would be adaptable to any press of suitable capacity.

Automobile and Aeroplane Statistics

The growth in exports of aëroplanes, automobiles, and motion-picture films has been especially rapid. The record of exports of aëroplanes and motion-picture films only began with the present fiscal year, and comparisons by years are not, therefore, possible. Of automobiles, however, the record extends back to the fiscal year 1902. During that period the exports have grown from $948,528 in 1902 to $17,594,336, in 1911, inclusive of automobile tires. For the fiscal year now approaching its close the total exports of automobiles and parts, will approximate, if not exceed, 25 million dollars in value. In the meantime imports of automobiles have grown at a less rapid pace, from $550,000 in the fiscal year 1902 to $2,250,759 in 1911, and an indicated total of approximately $2,500,000 in the fiscal year 1912. The import figure for 1912 is, in fact, much less than that of the fiscal year 1907, when the total was nearly 5 million dollars, thus indicating a marked decline in recent years in importations, though the growth in exportations during the same period has been very large.

In an English contemporary the following simple test for the quality is given: the article, which, of course must be small and is intended for cooking utensils, is heated over a gas flame until the heat scorches a piece of paper lying in the bottom. It is then plunged into cold water. It is claimed that a good quality of enamel will stand even this test without crazing.

Methods of a California Machine Shop

Special Correspondence

The important feature of the general system is the numbering of all drawings, patterns and machine parts in classes.

Planning and routing are systematically carried out. In the office of the production manager are records showing the state of the work in process and furnishing information for the control of production.

The George E. Dow Pumping Engine Co., whose new plant was described on page 250, makes use of some methods and systems which are particularly interesting. In their development an effort has been made to retain sight of the employee as a human being and to bridge over in some degree the gap which system, in general, tends to place between employer and employee.

While the company is organized and equipped to make pumping machinery as a specialty, it also does considerable work outside these lines. Its methods are not applicable solely to its special work but are capable of broad expansion.

Furthermore the difficulties of the problem are increased by the peculiar circumstances under which it and similar manufacturing concerns on the Pacific Coast must do business. The demand for any one engineering product is necessarily limited in a comparatively new country, while the variety of product demanded by the engineering field is almost limitless.

For this reason the Dow company is called upon to build pumps of all kinds and sizes and cannot confine its field of operations as a similar concern in the East would be able to do. The number of items which must be handled by its office system is therefore large, at present about 75,000.

Numbering System for Drawings, Etc.

Perhaps the most important feature of the system is the method of numbering drawings, patterns and machine parts. In many of the systems in use a machine part or pattern is identified through the complete machine itself by means of a group or drawing number or production order number, but in the Dow system all identification is by classes.

Thus a given kind of steam pumping engine would belong to a certain class. The cylinder as a whole would belong to another class, while the cylinder head of the steam cylinder would be indexed under still another class, the detail of classification being carried as far as desirable for perfect identification.

In the beginning a very complete classification was made of all the products of the company, and a system of numbering adopted, so that each class now has a distinctive number. The portion of this work which relates to pumps is very exhaustive and covers all forms of this class of machinery. The system has been extended, from time to time, to include products of the company outside its specialty.

The engineering office and drawing room are, of course, the starting place for all work, and from these a specification sheet is issued showing just what parts are required for the work in hand and giving the pattern number of all stock parts to be used. The new drawings and patterns which are required are numbered serially; but the drawing and pattern numbers of a given piece are not in general, the same, nor do they need to be.

Small drawing sheets are used for detail parts, and, in general, only one part is put on each sheet, though this is not essential. A card like Fig. 1 is filled out for each drawing and a card like Fig. 2 is filled out for each pattern, and these are filed in their respective card indexes, according to the class number, which is put in the upper right-hand corner.

If it is desired, then, to find the pattern

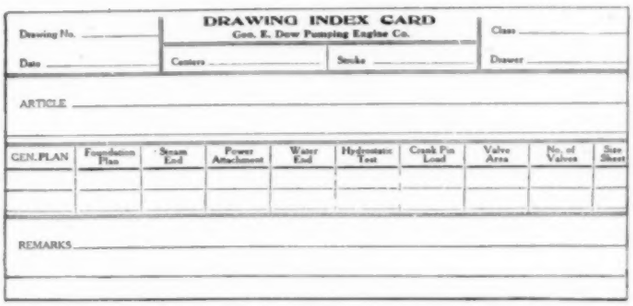


Fig. 1. Drawing Index Card

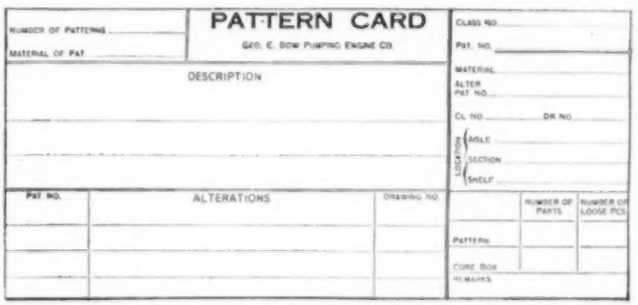


Fig. 2. Pattern Record Card

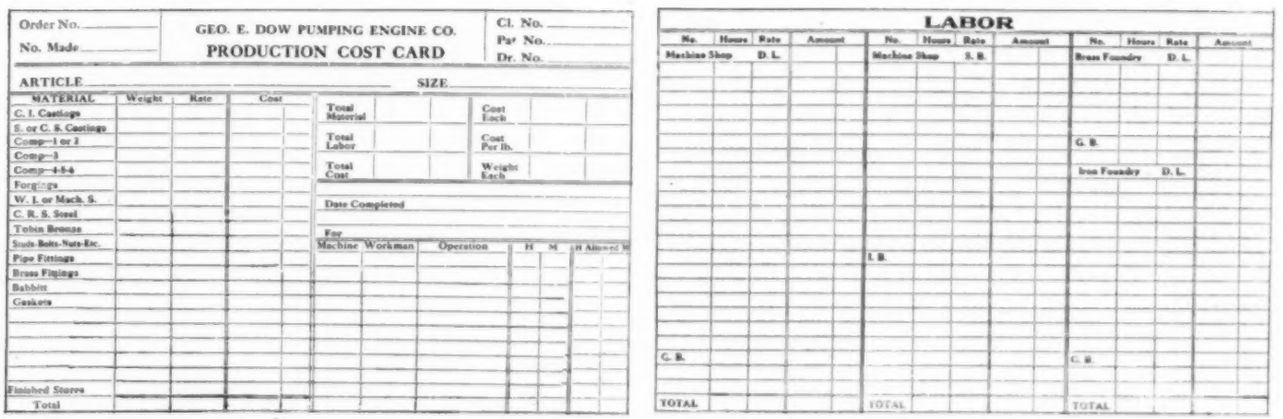


Fig. 3. Production Cost-card Form

for a steam cylinder head for a given kind of steam pump, search would not be made among the cards whose class numbers identify the general drawings of that class of engines, nor under the class numbers which identify steam cylinders, but under those cards whose class numbers identify steam cylinder heads; and there would be found all the pattern cards of all the steam cylinder heads ever made by the company arranged in order of size.

The pattern card locates the pattern and also carries the drawing number of the part. It is to be noted that the class of a pattern may or may not be the same as the class of the drawing from which the pattern is made. Where there is only one part on the drawing the class is the same for both drawing and pattern; but where several assembled parts are shown on a drawing, as for example in the case where a steam cylinder head is shown with the cylinder itself, the drawing would have one class and the pattern of the head another.

In general, however, identification can be made through either index. It is to be specially noted that the identification of a part is not dependent upon a production order or even on finding the class of the machine to which it belongs, but solely upon finding the class of the part itself. In the case of a definite line of work, such as the pumps built by this company, those who have to do with the records soon remember the class numbers of nearly all the parts and seldom have to refer to the main index.

Cost Records

The feature of having the records of all similar parts filed together is of great importance in looking up cost records for the purposes of making estimates or for setting time and cost limits on work going into the shop, as will presently be seen. The costs are recorded on the cards shown in Fig. 3 and these cards again record costs by classes. Thus the costs of complete machines appear in one class, the costs of assembled portions of a machine appear in another and finally the costs of individual parts appear under their proper class, arranged again according to size.

The amount of detail which may be obtained is under perfect control (through the drawing room) by the official who has charge of sending the work into the shop. The class, as before, determines the location of the cost card in the index and the costs of similar parts are therefore filed together. If then it is desired to find the cost of a given kind of steam cylinder head, by simply looking at the cost cards under that class number the cost of all the steam cylinder heads that the company has ever made would be found arranged according to pattern numbers.

ORDER NO. ..... GEO. E. DOW PUMPING ENGINE CO. CLASS NO. .....
DATE ..... **PRODUCTION ORDER** DR. NO. .....
LIST NO. .....
FOR .....

L.	NO.	NAME OF PIECE	CLASS NO.	DR. NO.	PATTERN NO.	MATERIAL	WEIGHT

DEPT.	TIME RECEIVED	TIME LEFT	DEPT.	TIME RECEIVED	TIME LEFT
OFFICE			CORE ROOM		
DR. ROOM			MOLDING		
PAT. SHOP			MACH. SHOP		

APPROVED	INSPECTED	RECEIVED IN GOOD ORDER
	DATE	DATE .....
	BY	STOREKEEPER .....

RETURN TO MANAGER'S OFFICE IMMEDIATELY UPON COMPLETION

Fig. 4. Production Order Form

It will be noted that the information tabulated on the cost card is very complete and in a very convenient form for estimating and predicting costs. In the lower left-hand corner is recorded the numbers of the machine tools on which the work has been done, the names of the workmen, the operation, the time which was allowed and the actual time used on each operation. The material of which the part was made is also recorded and the cost per pound as well as the cost per piece.

Planning and Routing

All work is carefully and systematically routed through the shop by a planning department, the foremen assuming only the duties of instructors and disciplinarians. This routing is accomplished in a very simple manner. When a production order, Fig. 4, is issued the routing clerk with the drawing of the piece before him notes upon the order, first, the routing by departments and, second, the routing by workmen in each department.

GEO. E. DOW PUMPING ENGINE CO.
PRODUCTION JOB

Order No. ..... Cl. No. .....
Date ..... Pat. No. .....
Workman No. ..... Dr. No. .....
Machine No. ..... No. Pcs. .....
Name .....
Article .....
BORE — FACE — TURN — MILL — PLANE — DRILL — TAP
Operation .....

DAY	IN	OUT	IN	OUT	IN	OUT	Total
MON.							
TUE.							
WED.							
THU.							
FRI.							
SAT.							
SUN.							

Time Allowed ..... Hours
Dept. Foreman .....

Fig. 5. Job Card Form

At the same time the job cards, Fig. 5 are made out for each workman who is to work upon the piece. These cards also indicate the time allowed as based upon previous records on the cost cards. The cards are returnable to the office and form the basis of new cost cards, Fig. 3, on which are again noted in the lower right-hand corner the actual time consumed and also the time allowed.

These job cards do not, however, go into the detail of giving each workman the sequence of detailed operations which he must pursue except the most important, but could be made to serve this purpose if desired. At present this is left to the ingenuity and initiative of the workman.

The production order number on which the machine is made is found on the upper left-hand corner of the cost card and by means of it the cost of any particular cylinder head is quickly found. The production order number on the cost card is the connecting link between the cost of any part and the job order on which the machine was built; but again it is interesting to note that it is not necessary to know the production order numbers to find the cost of machine parts, in general, and in fact as far as finding costs in general is concerned production orders may be disregarded entirely except where it is desired to find a specific cost.

The ease with which detail costs may be found with this system, especially for the purpose of predicting shop costs is apparent. The finding of recorded costs for the purpose of setting piece prices or time limits is one of the principal sources of wasted time and excess clerical expense in most cost systems. It would seem as though the above method reduces this expense to a minimum.

If the returned card shows that the workman has either greatly exceeded the standard time, or if he has markedly lowered it, the card is not buried in the files of the cost department but is forwarded to the manager's office where it is examined and filed as evidence of the workman's ability or lack of it. Such cards are of great service in assisting the manager in getting a line on his men directly and gives him a check on heresay evidences as to ability, a privilege which is usually cut off absolutely by the introduction of modern card systems.

Near each workman is hung a numbered, four-compartment order box, the several compartments of which are labeled respectively; "Job in Operation," "Next Job," Jobs to Follow" and "Suspended Jobs." Where a workman receives instructions to commence a piece of work, copies of the Production Order, Fig. 4, the production Job Order, Fig. 5, and the drawing of the part to which these orders refer is placed in the compartment labeled "Job in Operation." Succeeding jobs are similarly located in the other compartments according to the sequence desired. Thus the next succeeding piece of work is put in the pocket marked "Next Job" which gives an opportunity to prepare for it before the job in operation is finished.

Control Records of the Production Manager

In the office of the production manager are hung duplicate, four-compartment boxes, and in these are placed duplicate copies of the instructions given to the workmen in corresponding compartments, so that this official has always before him a miniature reproduction of the state of the work in process. Since also the Production Job card has the time allowance noted upon it he can tell at a glance just how long any man or machine is engaged in advance. The movements of work in the shop are directed from this office and corresponding changes are constantly being made in the individual boxes of the workmen.

It is to be noted that the workman is not paid on the basis of the Production Job order but on a time card made on a time clock; so that a job may remain suspended indefinitely without complicating matters or delaying any other part of the system. At present little or no work is done on the piecework or premium plan but it is evident that a small modification of the Production Job card will easily allow of this method of pay.

The Production Order, Fig. 4, and the Production Job order, Fig. 5, are, of course, made in several varieties and several colors in order to simplify classification of work and costs, but those shown are typical of the entire series. Several other forms of card are also used for special reports.

The completeness of the Pattern Card is worth noting. In the upper, left-hand corner is recorded the number of patterns on hand and the material from which they are made. This last item is an important one since it indicates at once what patterns have intrinsic inventory value as compared with those whose initial cost is really a charge against production. Any alterations which have been made to a pattern are noted and also the new number which has been assigned to it.

The exact location on the shelves is given and in the lower, right-hand corner is noted the number of parts which the pattern consists of, and the number of loose pieces, if any, which go with it. The same information is given for the corebox if there is one. Sometimes work is made to a sample, in which case this is also noted on the pattern card.

In carrying the work through the shop an effort is made to give each workman, as far as possible, only such information regarding the work as is necessary. In many cases skeleton drawings containing only the dimensions necessary for operation are furnished to the machine shop so as not to confuse the operator or waste his time with details or dimensions having no bearing on his work. This has long been recognized as good practice in making large forgings, but there seems to be no reason why intelligent application of this principle will not save much time and money in other departments.

The clerical force needed to operate the system is surprisingly small. Perhaps one reason for this is the fact that as much effort has been made to systematize the office work as that of the shop. No doubt many good systems fail because the planning department instead of adopting the very methods that it is striving to introduce into the shop, as a means of facilitating its own work, simply meets increased clerical work by increased clerical help.

In the Dow shops time studies are constantly being made by a very competent man who does little else and the same progressive methods are applied to every department of the works, including the manager's office. Such searching methods cannot fail to produce progress when operated in a humane and intelligent manner, as seems to be the case in this plant.

We are indebted to Wallace H. Dow, manager of the works and who is also the originator of the new features of the system, for giving so freely and cheerfully of his experience for the subject matter of this article.

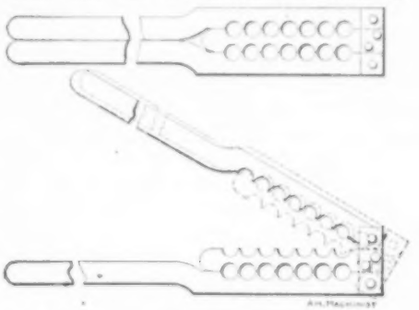
According to a bulletin recently issued by the Census Bureau, there were 13,930 wage earners employed in petroleum refining during the year 1909; this was an increase of 14.2 per cent. over the number employed in the year 1899, when the preceding census was taken.

Tongs for Holding Small Parts

By G. Roberts

The cut shows a novelty in the shape of a pair of tongs I made to hold small parts for lead hardening. With these tongs I can handle in two hours the same number of parts formerly handled in a day. To make this plainer, I can handle 14 pieces with the new tongs where before I could only handle 2 pieces at a time. The size of the part mentioned is ⅜ in. in diameter by 6 in. long.

The tongs are made from light material and are constructed so that the



Tongs for Holding Small Pieces

parts can be placed in two separate rows, each piece being independent of the other. The size of the material used is ⅛x½-in. cold-rolled steel. The center piece, or clamp, is ⅛x½x4 in. long and is riveted in the center between two pieces ⅛x½x1½ in. long.

The tong sides are fastened on each side of the center piece by a fulcrum pin, so that when they are lying on one side you can open the center piece and fill the bottom row by holding the bottom tong side and moving the top forward. After filling the bottom row, to clamp the pieces, bring the top tong side toward you; this clamps the bottom row and gives space to fill the top row. After the top row is filled close the tongs the same as an ordinary pair. To release the parts simply open the tongs and all the pieces will fall out together.

The United States is apparently leading the world in the production of cement for industrial purposes. The latest figures available in the Bureau of Statistics with reference to production in various parts of the world places the production in Germany at about 30 million barrels, or considerably less than half that of the United States, and that of England, slightly less than 20 million barrels. Of the 78 million barrels produced in the United States in 1910 a very large proportion is consumed at home, the exports for that year being but about 2½ million barrels. The total consumption in the United States, according to the best available figures, has grown from about 20 million barrels in 1900 to 74 million in 1910.

Miller Fixtures for Camshaft Bearings

By Harold E. Murphy

The fixtures shown are composed of a cast-iron body and machined only where marked *F*. They can be made long enough to take as many parts as desired by simply changing the design in regard to length.

Fig. 1 shows the fixture for holding the caps, and they are put into it by letting them bear against the stop screw, which is shown headless; then the strap *A*, which hinges on a pin, is brought down and fastened by the small L-shaped lock. The setscrews in the strap are next run down lightly and the square-head setscrew *B* is tightened and then the setscrews in the cap are tightened, and the caps are ready to be machined.

A gang milling cutter is used which will take the whole surface to be machined in one operation. The design of this fixture is simple and so designed that the caps can be taken out and another set put in in a very short space of time, which is the main thing to be considered in all jigs and fixtures.

Fixture for Milling Bearing Cap Sets

This fixture, Fig. 2, is cut away, as shown, to lighten it, and the walls are strongly supported by the ribs, which extend from the top of the fixture to the base, making a rigid construction.

The bearings are placed in the fixture as shown, setscrews *A* being used for stop screws. By tightening up on the setscrews *C*, the bearing is held firmly in position while machining.

Machining the Bottom of the Bearings

To simplify the casting of the fixture, shown in Fig. 3, the end is separate and bolted on with cap screws. There are four cored holes, two on each side, to lighten it. A bar extends through the fixture, as shown, being held at one end by a nut and centralized on the other by a strap which fits onto studs *A*.

The bearings are placed on the bar with separating collars, as shown, and the caps put in position.

Setscrews *B* are for locating points and *C* to tighten up with.

As will be seen by the illustrations, the bearings can be machined to exact measurement very economically and accurately.

Manufactures form by far the largest part of exports from the United States to Mexico under ordinary conditions. Of the 60 million dollars worth of domestic merchandise exported to Mexico during the fiscal year 1911, manufactures of iron and steel alone amounted to over 20 million dollars; cars, about 2 million; boots and shoes, and other manufactures of leather, about 2 million; cotton-seed oil, nearly 2 million; lumber, nearly 3 million; scientific instruments, more than 1 million; chemicals, chiefly manufactured, over 1 million; explosives, nearly 1 million; automobiles, over ½ million; agricultural implements, over ½ million; and a large number of other manufactures in less sums.

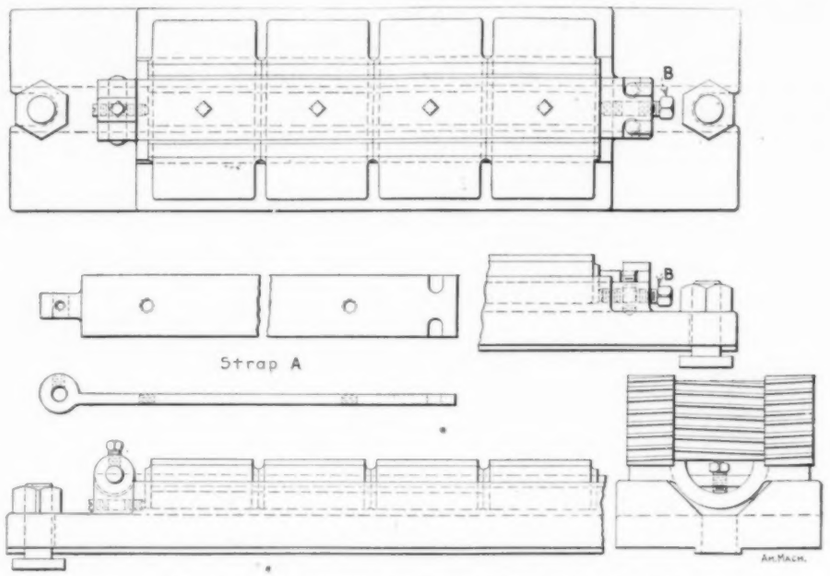


Fig. 1. Miller Fixture for Camshaft-bearing Caps

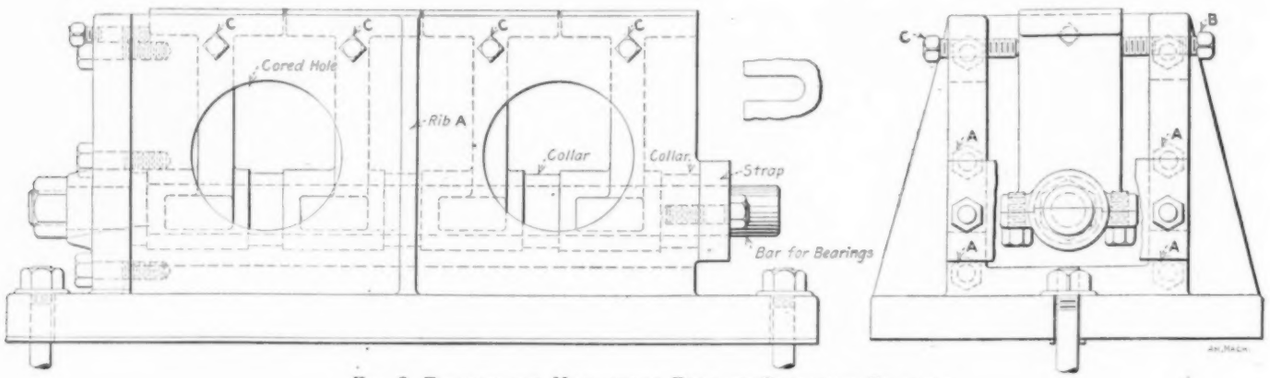


Fig. 3. Fixture for Machining Feet of Camshaft Bearing

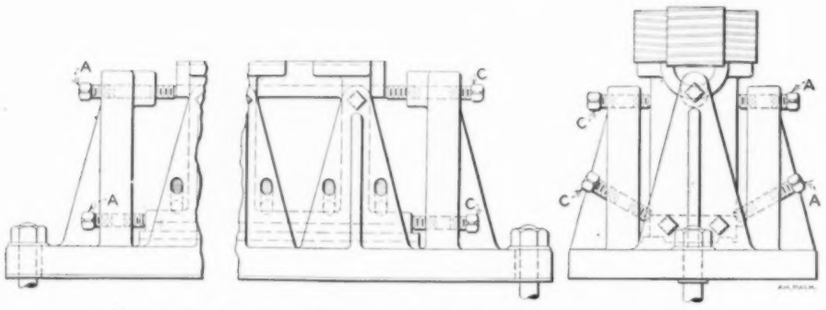


Fig. 2. Fixture for Milling Camshaft-bearing Cap Seats

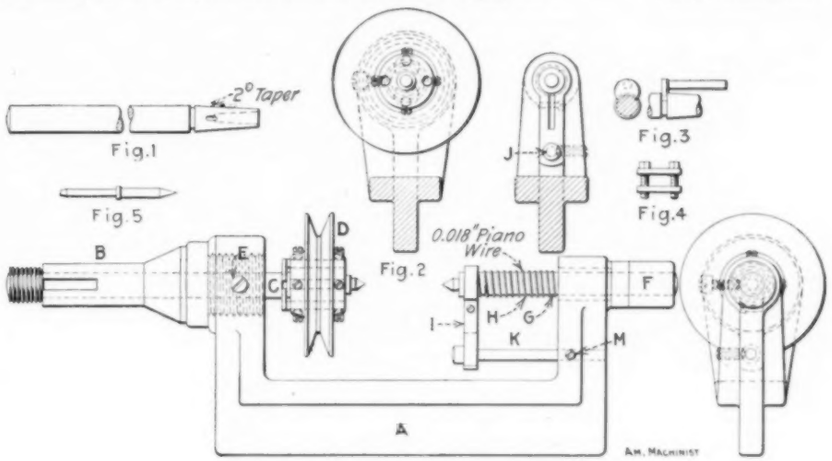
Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

A Dead Center Grinder

In manufacturing watches on a large scale many admirable devices are employed in making the tools. Among others worthy of note is the dead-center grinder shown.

The boss on the bracket *A* is threaded internally to fit a thread cut on the front end of the standard spring-chuck blank *B*. A hardened, ground, and lapped spindle *C* passes through *B*. The spindle *C* is tapered at its front end to fit a taper hole in the pulley *D*, which revolves upon it. The detail of *C* is shown in Fig. 1, while the other view of *D* is shown in Fig. 2.



A Dead-center Grinder

Two of the holes in Fig. 2 are occupied by the lockers, Fig. 3. The other two carry driving studs (these taking the place of the tail when using the dog, Fig. 4) secured by means of screws fitted into the tapped holes. The setscrew *E* secures the spindle *C* at any desired point. A hard-steel bushing, acting as a bearing for the spindle *G*, is seen at *F*. A coil spring *H* is placed on the spindle, and is held on by the yoke *I*.

At the lower end of the yoke a hole *J* permits the stud *K* to pass through it, thence into the hole in the bracket *A* where it is secured by the screw *M*. The attachment is used in a bench lathe with its belt thrown off, securing the lathe spindle in some manner. The pulley *D* is connected by the belt with a small pulley on the countershaft, while the pulley on the slide-rest grinding attachment is belted to the large pulley on the same shaft.

A sample of some work to be ground and lapped is seen in Fig. 5. In grinding work of this kind I turn male centers on the work, then use female centers in the attachment in place of those shown. Good results were obtained by using a 3-in. Richardson emery wheel (W) 120 grain, running the wheel at 8000 r.p.m., and the work at 2600 r.p.m.

Elgin, Ill. GUS HAESSLER.

A Thread Cutting Job

A yoke, of bessemer steel, used in the construction of lithographic printing presses is shown in Fig. 1. We had been boring and tapping the hole shown in a radial drilling machine. This method, however, had several objections; including the cost of taps. The thread is a one-sixth pitch square thread, and we broke about one tap for every five or six yokes tapped. The best of special taps failed to give satisfactory service, especially when we tried to back them out instead of running them through.

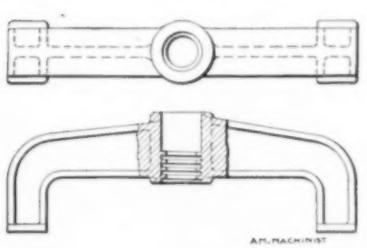


FIG. 1. YOKE WITH HOLE TO BE BORED AND TAPPED

It therefore became necessary to find a better method. Fig. 2 shows the job on a 14-in. Bradford lathe. It was necessary to block up the job considerably. The tool carriage, of course, was removed, leaving only the bridge and apron. Once proper blocking, bolts and clamps were found, the subsequent yokes were machined in much less time. The *modus operandi* was as follows:

The yoke was blocked up on the carriage, to approximate the necessary height, and a piece of wood was placed and centered in the bore. The carriage was then run down to the live center,

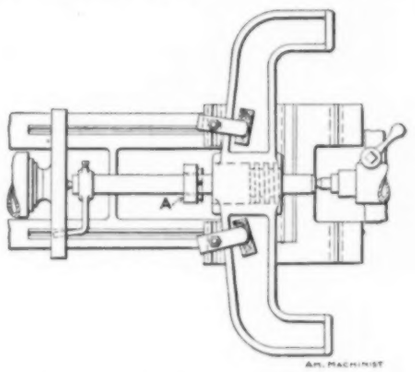


FIG. 2. JOB RIGGED ON THE LATHE

and by means of additional blocking and wedges the center piece of wood was lined up with the live center, and the job clamped down, as shown. The hole was then bored with a bar and two cutters, one cutter for each diameter.

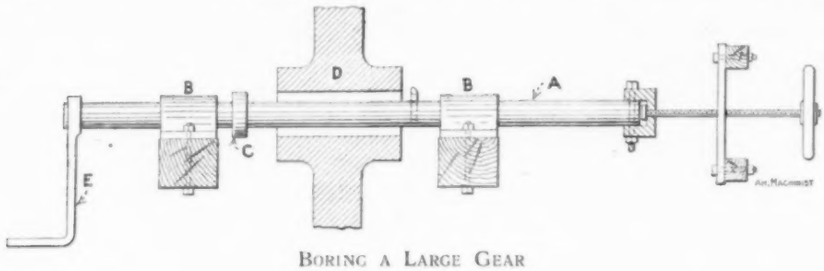
Next the bar shown in Fig. 2 was set, driven by a dog, as shown. This bar carries the threading tool, which is held, as set, by means of a setscrew. To hold the tool to its work, and prevent chatter, the floating collar *A* is used, and must be kept well down in the large, or clearance bore. When the tool has passed through the work the lathe must be reversed and the tool backed out, and set for the next cut. The last cut should be run through twice without any further adjustment. The reason for this is, that in spite of all precaution, the tool will spring off a little, and repeating the cut brings the threads true.

Of course, any attempt to loosen the tool, run the carriage back by hand, and "catch" the thread will meet with failure. As will be noted, the bar is stationary, and the work is fed to the cutting tool by the lead screw, the usual thread-cutting gears being used. This idea will be found worth while, if it happens to be new.

Danville, Ill. A. C. HENRY.

Boring a Large Gear by Hand

The cut shows a boring job recently done by hand and in a very satisfactory way. The gear shaft on a mine pump was broken and it was desired to bore out the seven-foot gear to take a shaft ⅛ in. larger. As this was a large, rough gear



BORING A LARGE GEAR

and ran very slowly it did not have to run exactly true. Time was of importance as the mine was filling up with water.

I took a 3-in. boring bar *A* and found two solid boxes *B* that were a good running fit on the bar. These were bolted to a timber, one on each side of the gear. The collar *C* was then made so that it was a sliding fit on the bar, and the outside diameter of collar was a sliding fit in the hole in the gear hub *D*. When the bar was set so that collar would slide through the hub easily it was true with the old hole.

The cut shows the manner of feeding. A crank *E* was put on the end of the bar and the job was completed in a very short time without moving the gear. The only objection to the job came from the man turning the crank.

Platteville, Wis. I. L. HENSLEY.

Some Drilling Suggestions

The following are a few rules which will be of help:

When there are several holes of different sizes to be drilled in a piece, always drill the smaller ones first, as it is easier to enlarge a hole than to make it smaller.

When fitting bushings, plugs or dowels to holes of different sizes, always fit the larger ones first, because if you get too loose a fit on one you can slip it into a smaller hole, whereas you only have one chance when you get to the smallest hole.

In drilling for a tapped hole, always run a body-size drill in until it cuts full size. It not only makes a neater appearance, but you can find the center for a measurement easier, and sometimes you might want to counterbore some of the threads.

When a smaller drill is to follow a larger one, as in the case of spotting through and drilling for a tapped hole, grind the smaller drill a little less acute, so that it will bear on the sides and not on the point, and thereby follow the location of the spotting drill.

You can make a drill bore nearer to size by running the next size smaller through first and then reaming with the size you want to finish, because a drill cannot bore a larger hole than its diameter, except when the point has a bearing and is doing work. This is the reason why a larger hole than the diameter of a drill can be obtained by grinding one lip longer than the other, and the longer lip cuts its full length.

L. T. CODDINGTON.

Syracuse, N. Y.

An Adjustable Hollow Mill

To overcome the disadvantages of the common one-piece hollow mill, and at the same time obtain a tool which would give the results of a finishing box tool, the adjustable hollow mill shown was developed.

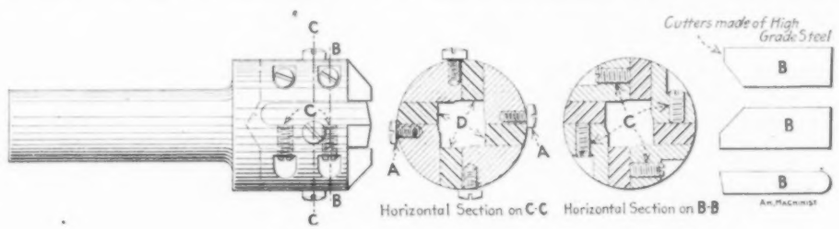
A piece of free-turning machine steel is turned to fit the turret hole. The slots *D* are milled to receive the cutters *B*. The face, or cutting edge, of these cutters is given a slight clearance angle longitudinally, and is held in place by the binding screws *C*. A second set of screws *A* is used to prevent the cutters from working outward, due to crowding the cutter onto the work. Allowance is made on the end of the cutters for grinding as they become dull. The cutters are made of high-speed steel and fit the slots without play.

To set the tool, put a sample of the work in the collet or chuck of the lathe, insert the hollow mill in the turret and lock in position. Bring the turret forward until the faces of the cutters strike the face of the work. The cutters, which have previously been loosened, are now set snugly in place to conform to the diameter of the work. Now set the turret stop, and the tool is ready for work. By setting the tool up in this way, each cutting edge does its proper share of cutting.

This tool has been in use in our shop for days at a time without giving the slightest trouble by becoming dull. Our work comes accurately to size without the aid of an additional box tool.

A. R. COOPER.

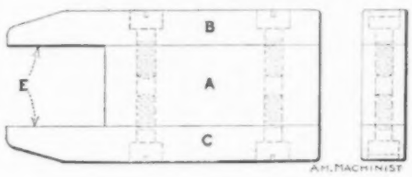
Marshalltown, Iowa.



AN ADJUSTABLE HOLLOW MILL

An Adjustable Snap Gage

I would like to criticize the snap gage by Chas. M. Turner shown in Vol. 36, page 31. It does not seem to be a practical tool, for use by unskilled help, as the end of the pointer may bend from position. Also, theoretically, you have only a line across the gage jaws for actual use.



AN ADJUSTABLE SNAP GAGE

A gage made as shown in the cut would be more practical, as when the jaws *B* and *C* are worn, you take them from the body *A*, lap them on the faces *E*, put them back, and the gage is as good as new.

Bayonne, N. J. G. A. KOSCH.

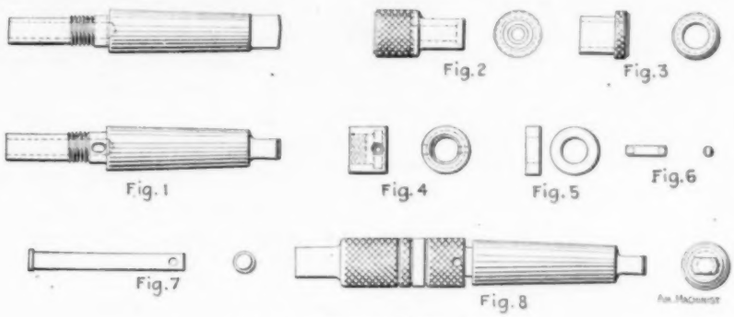
An Adjustable Test Plug

A tool very much needed by tool and jig makers, is an adjustable test plug which can be quickly and perfectly trued up so that in boring holes the correct position can be accurately found. The one illustrated is the best I ever used.

The shank, Fig. 1, is turned taper to fit the miller or borer collets, care being taken that all parts are true. The slot is cut 0.160 in. wide to allow for movement of the pin, Fig. 6. Figs. 2 and 3 are made to fit each other and are eccentric, 0.005 in. making a complete throw of 0.010 in. Fig. 4 is a nut that fits the thread in Fig. 1 with a recess cut for the end of the pin in Fig. 6. The hole in the pin,

Fig. 7, is made so that Fig. 6 will drive. Fig. 5 is a collar driven on the end of Fig. 1 as far as the thread, and forms a bearing for the plug parts when tight.

To assemble Fig. 8 screw nut Fig. 4 on thread of Fig. 1 until the pin hole is in line with the slot, then drive the collar Fig. 5 on and turn the side next to the plug parts. Next put on Fig. 3 then Fig. 2, then insert Fig. 7 and turn round until hole is in line with slot. Next drive in pin, Fig. 6, care being taken that the flat ends are at right angles with the center line of Fig. 1.



AN ADJUSTABLE TEST PLUG

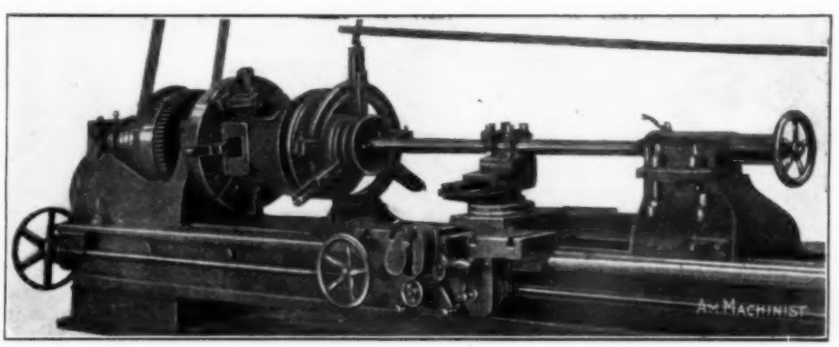
By turning the nut backward it will move toward the taper end causing the pin to draw Figs. 2 and 3 back against the collar, thus locking them. I find that the best way is to tighten the nut hard enough to hold Figs. 2 and 3 in place but allowing them to be moved with the fingers; they can thus be trued up very quickly.

MYRON D. NICHOLS.

Beverly, Mass.

Rigging an Engine Lathe for Reboring Gas Engine Cylinders

The illustration shows a vertical gas-engine cylinder closed at the upper end, except for the openings for the valve cages which are off center, and it is not possible to get a boring bar through the cylinder.



ENGINE LATHE RIGGED TO TAKE VERTICAL GAS-ENGINE CYLINDER

In most machine shops there is usually found a horizontal boring mill with a stiff boring bar and cutting head for boring such cylinders. However, in the course of time it becomes necessary to rebore the cylinders, and this is usually done in a repair shop where an engine lathe is about the only tool available for the job.

To determine whether or not such a job could be done satisfactorily on an engine lathe it was decided to make a practical test. By referring to the halftone, it will be seen how the lathe was rigged for the work. A shaft of suitable size and length about two and one-half times the length of the cylinder, was selected for a boring bar; one end of this shaft was turned to fit the tailstock center, the other end was slotted and tapped for the tool. The boring bar was then put in the lathe and clamped about the center in the tool block.

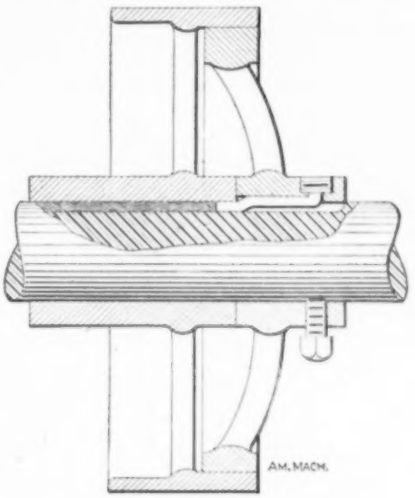
The upper part of the tailstock was loosened and set over until the boring bar was parallel with the axis of the cylinder, and then clamped in this position; the lower part of the tailstock was loosened to slide on the ways of the lathe as the carriage moved the boring bar into the cylinder. The crossfeed of the tool post was used to make final adjustment of the tool for the size of the bore. The cylinder was chucked from the top end, and the opposite end supported in a steady-rest.

The job was carefully set up as described and the boring done. On completion, the cylinder was found to be as true as if done on a boring mill designed for such work.

Warren, Penn. L. H. BURKHART.

A Lubricating Device

Everyone who has to oil the countershafts in a shop knows what a trying job it is, when the counter belts have to be run off the main line in order to bring the oiler in the pulley hub into proper position to receive oil. The device illustrated obviates all this trouble, as the oiler can be brought into position by a pull on the belt connected with the machine.



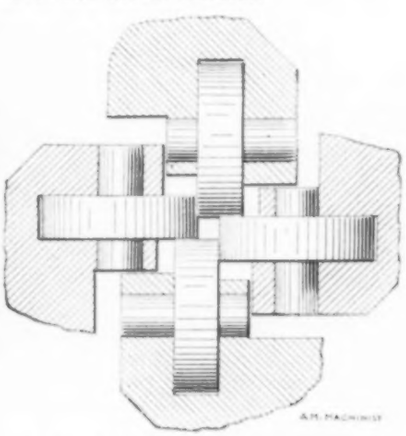
A LUBRICATING DEVICE

A slot is cut in the countershaft and the part under the pulley hub is filled with felt. An oil tube is fitted into the hub of the friction disk, so as to allow the disk to be put over the end of the shaft. The end of the oil tube extends under the end of the pulley hub. Any good reservoir oil cup may be used.

Dexter, Me. E. W. TATE.

An Adjustable Draw Plate

The cut shows an adjustable draw plate or turk's head which possesses some novel and useful features.



AN ADJUSTABLE DRAW PLATE

The drawing rolls are supported on bearings arranged at an angle of 45 deg. with the line of travel of the supporting

jaws, one edge of the jaw and one edge of the roll carried by it moving on a line that will meet on a common center.

These jaws can be made to attach to the jaws of a universal chuck or, if preferred, a special holder can be made. This holder can be either square or round and the jaws can be operated either independently or together.

Made as shown any size of wire or tubing, from ½ in. to zero, can be drawn. On the same principle, with three jaws, triangles, and with six jaws, hexagons, can be drawn.

Philadelphia, Penn. R. C. FAY.

Cutting Keyways on the Shaper

The halftones illustrate a method of keywaying with a saw on the shaper.

A work plate bolted to the table is shown at *A*, Fig. 1. At *B* is a plug fitted in the work plate *A* and has a slot through which the saw travels; the saw *C* is so made that each tooth removes 0.0002 in. Two jamscrews that thrust against the column of the machine to prevent the table from lifting are shown at *D*. The work to be keywayed is designated at *E*.

In Fig. 2 *F* is the drawbar, the end of which is fastened to the saw with a flat key; the drawbar head *G* is bolted to the ram. The drawbar clamps are at *H*, while *I* is the drawbar clamp swivel-bolt.

With this arrangement we are cutting with six 6-in. strokes of the shaper, a ¼-in. keyway in steel 5 in. long.

Covington, Ky. A. B. SOWDON.

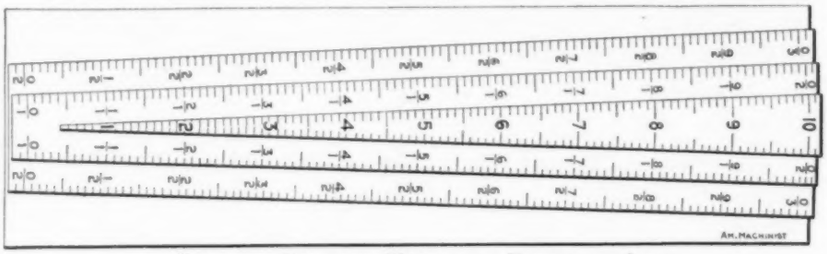
Measuring Reduction of Area

When measuring test specimens, a difficulty arises in determining the percentage of reduction of area at the break, because its irregular nature renders a micrometer of little use. The points of measurement on it are too large. The usual method is to caliper, taking an average across the break.

The gage shown was made to enable the distance between the points of the calipers to be measured more accurately than by applying a rule. It consists of three graduated taper plates, riveted together on a base plate, each plate being 17 S. W. gage (0.058 in. thick). The plates are graduated to tenths and hundredths.

An elongation rule is also a useful tool in the test room, the various lengths 6, 8 and 10 in. being left blank, and graduations, each corresponding to 1 per cent., made on the continuation of the distance specified as the best length. The elongation can thus be read direct as a percentage.

London, England. A. L. HAAS.



DIAGONAL GAGE FOR MEASURING REDUCTION AREA

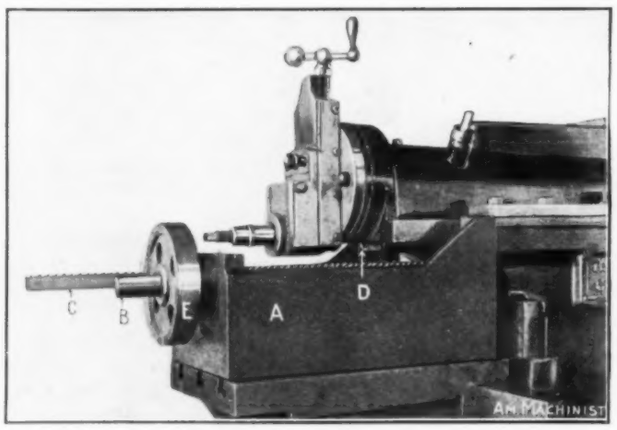


FIG. 1

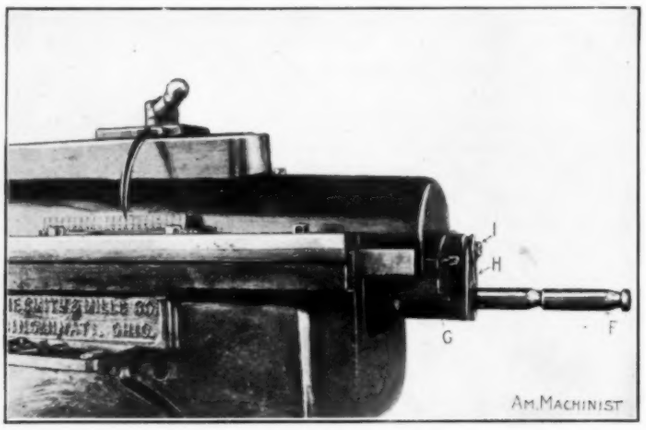


FIG. 2

DETAILS OF KEYSEATING WITH A SAW ON THE SHAPER

A Correspondence Record

A large industrial corporation, having several distinct departments for the manufacture of special machinery, has adopted a system for keeping track of correspondence which practically insures proper attention to each letter received.

As the letters come in they are numbered and each number entered on a card, with the name and address of the writer and a very brief resumé of the subject matter, as, for example: "Sharp & Towne ask for quotation on special hydraulic press," or "Swift, G. B., asks when shipment of accumulator will be made."

On the card is also noted the individual to whom the letter is referred and a carbon copy is sent to the department head. Clerks entrusted with the opening and recording of mail arrive at a sufficiently early hour to insure delivery at the proper desks when business begins for the day.

The cards are then looked over by an assistant to the manager and the latter's attention is called to any matters of importance, including complaints of customers, which he may wish to look into.

Thereupon the cards go to a file clerk and are subsequently checked against the letters as these come to him for filing with their replies attached. After a certain number of days, if any cards remain in the tickler, the file clerk sends notices to the heads of the departments interested, asking why no replies have been made to the letters in question. These are then looked up and attended to without further delay. At present, however, there is seldom occasion to send such notices, for the system has resulted in practically immediate attention to all correspondence.

It also prevents the accumulation of letters in the manager's office or the offices of department heads, as the cards give them a comprehensive survey of each day's mail, and the complete record of letters received from a customer is always available in condensed form. The latter has proved of particular advantage to the branch offices, which frequently ask for digests of it, and also to the traveling salesmen, who look over the cards of their territory as often as they come in.

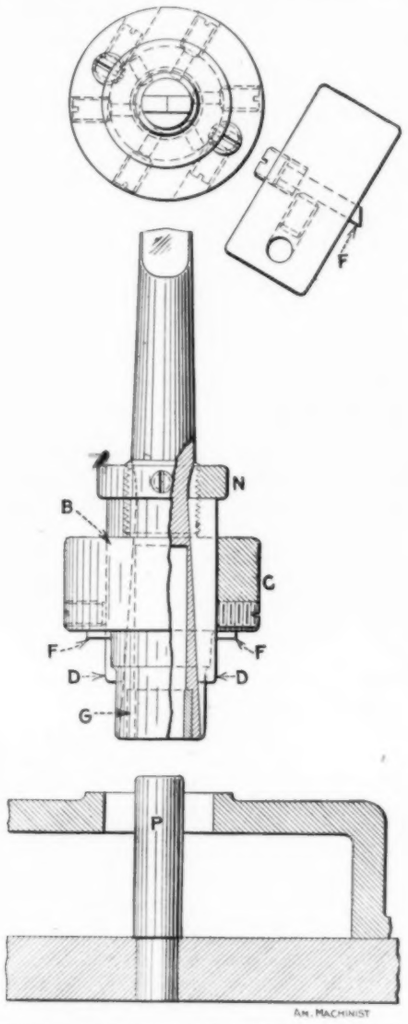
Of greatest importance, however, has been the elimination of all negligence in the conduct of correspondence, from

which many firms engaged in one of the metal-working industries are chronic sufferers. The company referred to had sustained serious losses from lack of proper attention to letters received, but since the new system was put in force there has been no difficulty on that score.

Milwaukee, Wis. C. A. TUPPER.

Combined Boring and Facing Tool for Cored Holes

The illustration shows a combined boring and facing tool, designed for use in a drilling machine in work that can-



TOOLS FOR BORING AND FACING CORRECT HOLES

not be conveniently handled in a turret lathe or where a turret lathe is not available.

It consists of a body *B*, provided with a guide bushing *G*; six boring blades *DD*, two facing blades *FF*, an adjusting nut *N*, and the collar *C*, which carries the facing tools, binder screws and adjusting screws. The guide bushing *G* is hardened and ground and fits over the guide pin *P*. The body *B* is of machine steel, and bored out, as shown, to pass over the guide pin.

The slots for the boring blades are in an angle, so that a standard size can be maintained by adjusting the blades with the nut *N*. The boring blades *DD* are hardened and ground to a sliding fit in the slots and are clamped by the binder screws in the collar *C*. The facing blades *FF* are carried in the collar *C*, adjusted and clamped by headless screws, as shown. The collar is a press fit on the body *B*. The guide pin *P* is fixed in the drill press table or in the fixture for holding the work.

The first cost of this tool is considerable, but except for the wear on the blades it will last indefinitely, and the blades can be replaced at small expense.

G. W. RAWSON.

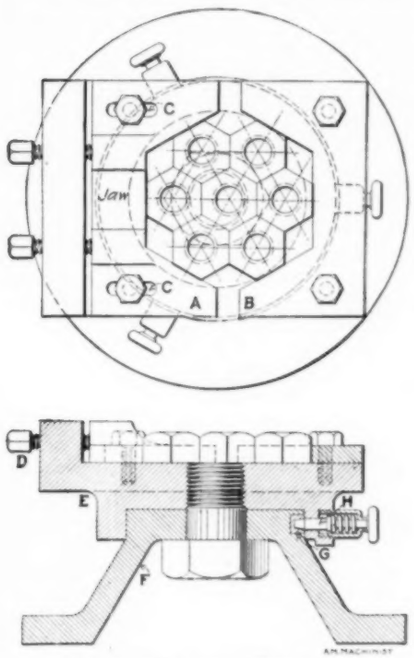
Cleveland, Ohio.

A Castellating Fixture

The cut shows a simple castellating fixture with which we are able to castellate nearly 200 half-inch nuts per hour.

The jaws *A* and *B* are made of hardened tool steel. The jaw *A* is provided with the elongated holes *C* to permit it to be tightened against the work by the setscrews *D*. The jaw *B* is stationary.

The member *E* is bored to fit the base



A CASTELLATING FIXTURE

F. Three indexing bushings *G*, 120 deg. apart, are located in the base *F*. The indexing pin *H* is located in the member *E*. The saws are spaced as shown and three cuts across will put six slots in seven nuts.

Milwaukee, Wis. W. BUTZLAFF.

Fastening Split Gears

Split gears are sometimes fastened with studs and cotters, as in Fig. 1. This fastening is, however, recommendable only where the teeth are narrow and where it is machined on a cotter miller which reverses with great regularity.

Where the teeth are broader the cutting of the cotter hole is not easy because the tool for boring it is weak in relation to its length and easily breaks off if clogged with chips. Moreover the cotter must be fitted by hand, smoothly and

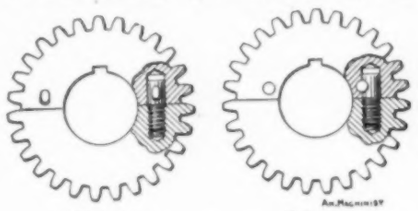


FIG. 1 FIG. 2

FASTENINGS FOR SPLIT GEARS

accurately, which takes time and costs money.

The device shown in Fig. 2 is much simpler and cheaper; it is also stronger. Instead of the elongated cotter holes, as in Fig. 1, there are drilled only two cylindrical holes having the size of the smallest diameter of the conical pins used, and these holes are reamed out with a slightly tapered reamer.

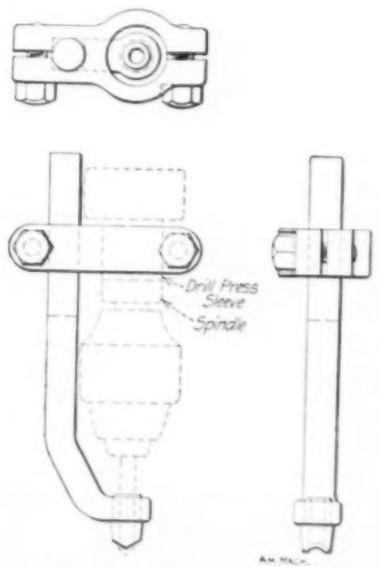
The semicircular notches in the two studs are fitted to correspond with the tapered pin holes, being worked out with a file. In the studs there must be play below the pins and sufficient material above them for taking them up with the pins.

Because of the greater friction surface and shearing surface of the conical pins the fastening is surer and more durable than the former one.

Rixdorf, Germany. F. GINZEL.

A Counterboring Depth Gage

The illustration shows a depth gage to be used on a drilling machine when counterboring for screw heads or similar work.



A COUNTERBORING DEPTH GAGE

This gage is especially useful on work that varies in thickness or where the essential thing is to have all screws project a uniform distance.

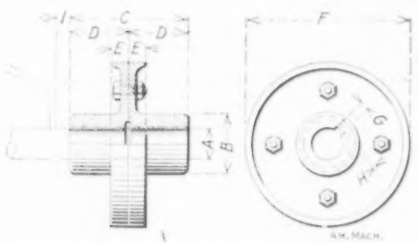
Dayton, Ohio. FRANK L. WALTER.

Dimensions for Cast-Steel Flange Couplings

The accompanying table represents standard dimensions for cast-steel flanged couplings, and the diagram shows their application as practiced by a large electric company.

Size of Shaft A	B	C	D	E	F	G	H	I	Horsepower Rating per Revolution, with 33,000 Lb. Torsion in Shaft	Approximate Weight
1"	2"	4"	2"	1"	5¼"	¼"	¼"	¼"	0.0102	10
1¼	2½	6	3	1⅛	5¾	⅜	⅜	⅜	0.0200	13
1½	2¾	6	3	1¼	6¼	⅜	⅜	⅜	0.0346	20
1¾	3	8	4	1⅜	7	½	½	½	0.0550	27
2	3½	8	4	1½	8½	½	½	½	0.0821	40
2¼	4	10	5	1¾	9½	½	½	½	0.1604	53
3	5	12	6	1¾	10½	½	½	½	0.2770	80
3½	6	12	6	2	12¼	½	½	½	0.4400	130
4	6½	14	7	2⅛	13	1	½	½	0.6670	160
4½	7½	14	7	2⅜	14	1	½	½	0.9355	200
5	8½	16	8	2¼	15½	1½	½	½	1.2832	280
5½	9	16	8	2⅜	16½	1½	½	½	1.7081	320
6	9½	18	9	2⅜	17	1½	½	½	2.2176	410
6½	10½	18	9	2⅜	19	1½	½	1	2.8195	465
7	11	20	10	3⅛	20½	1½	½	1	3.5210	595
7½	12	20	10	3⅛	21	1½	½	1	4.3310	660
8	12½	24	12	3⅛	22	1½	½	1	5.2570	840
8½	13½	24	12	3⅛	23	1½	½	1	6.3050	965
9	14	28	14	3⅛	25	2	½	1	7.4840	1315
10	16	32	16	4	27	2	½	1	10.2670	1650
11	17½	32	16	4⅛	28½	2½	1	1	13.6650	1950
12	19	36	18	4⅛	31¼	2½	1	1	17.7410	2580
13	20½	36	18	4⅛	33	2½	1	1	22.5560	2970
14	22	40	20	5	35½	2½	1	1	28.1730	3775
15	23½	40	20	5⅛	37½	2½	1	1	34.6510	4320
16	25½	48	24	5⅛	39½	3¼	1¼	1	42.0530	5730

DIMENSIONS FOR CAST-STEEL FLANGE COUPLINGS



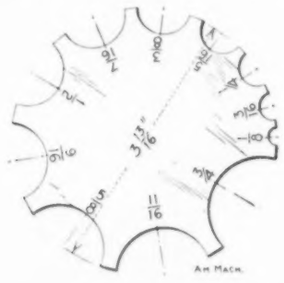
DIMENSIONS FOR CAST-STEEL COUPLINGS

A Radius Gage

The blueprint of a gage that I had made for my own use to find the radius of the head of special bolts is shown in the diagram. The gage is marked off in sixteenths, but if a head is too flat for one radius and too sharp for the next, it is probably in thirty-seconds; I make a paper template with dividers to be sure.

DAVID T. FLETCHER.

Cleveland, Ohio.



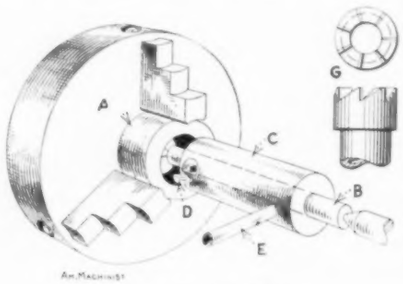
A RADIUS GAGE

Boring Cored Holes

A great deal of time can be saved when boring cored work on the lathe, if the method shown in the cut is used. It operates just as well on work where the core is badly out of center as it does on concentric holes and a heavier cut can be taken than with the ordinary boring bar held in the tool post. There is the further assurance that the cutter will not spring away from the work to any great extent.

The work *A* is chucked either in a jaw chuck or against the faceplate. The centers are put in both spindles, on the cylindrical bar *B* placed between the centers. On it is placed a sleeve *C*, of any convenient material, bored a sliding fit for *B* and carrying a cutter *D* and the bar *E*. The bar *E* rests on the tool-post slide. The sleeve and cutter are fed to the work by the bar *E* coming in contact with the tool post, the feed motion of the carriage having, of course, been thrown in.

The bar *B* supports *C*, so that, even when the work is so eccentric that the tool is cutting air on one side, it is not pushed away when it comes in contact with the high spots.



BORING CORED HOLES

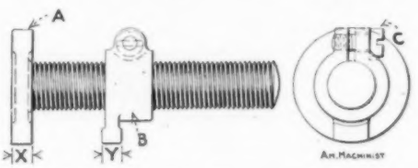
For small work it pays to make a sort of end mill, as shown at *G*, to take the place of the sleeve *C*.

New York, N. Y. E. A. DIXIE.

A Gage with Various Uses

The little tool shown is one which any tool maker can make for himself and is well worth the time and trouble required to make it.

It may be used as a snap gage, both inside or out. For a gage when cutting large keyways it has no equal. It will serve very well as a limit gage, provided there are two of them on which to set the maximum and minimum dimensions.



A GAGE WITH VARIOUS USES

As a height gage it is also very useful. Its scope as a height gage is not large but worthy of mention. As a matter of fact it serves in almost any place where a rigid and accurate gage is needed. Other uses may suggest themselves to different users.

There are only three parts to it. Part *A* is the base and principal part. It is best made of tool steel, hardened. The large circular portion of this piece is accurately ground and the thickness *X* is made any convenient thickness, for instance 0.2000 in. Note the relieving on both sides of this partition of *A*. This is chiefly for ease in grinding. The remainder is a spindle on which a fine pitch thread is cut. This thread might be made ½ in., 24 threads or any other fine pitch to suit the set of special taps in stocks, as *B* has to be tapped later to fit. The thread should be accurately lapped and the tapped hole in *B* should fit it perfectly.

Part *B* is preferably also of tool steel, hardened. It should be fitted to screw on *A* very snugly, then split as shown, and provision made for the screw *C*. It should next be bound on *A* by the screw *C*, and the feeler accurately ground on the centers. The dimension *Y* should be 0.2000 in. or the same as *X* on *A*.

All the settings are made by screwing *B* up or down *A* and measuring with a micrometer over the feeler on *B* and the base on *A*. Thus, for an outside snap gage the tool is set in the same manner except that the thickness of the base and feeler are added to the reading on the micrometer.

S. VICTOR BROOK.

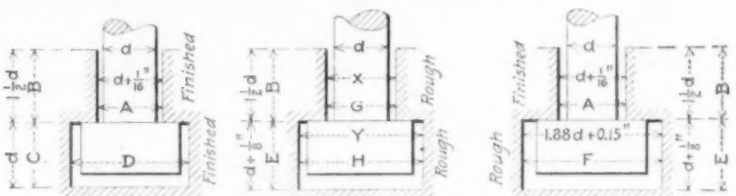
Middletown, Conn.

Discussion of Previous Question

Referring to letters and articles previously published

T-Slots for Machine Tools

In Vol. 36, page 516, Carl G. Barth mentions a standard for T-slots in machine tools in use by William Sellers & Co. The accompanying cut and table give the proportions of this standard, and the two following paragraphs are from a letter of Coleman Sellers, Jr., written in explanation. As given, the standard has



d	A	B	C	D	E	F	G	H	X	Y
½"	29/16"	5/4"	1/2"	1"	5/8"	1 1/16"	9/16"	1"	d+1/16"	1.5d+1/2"
5/8"	1 1/16"	1 5/16"	5/8"	1 1/16"	5/8"	1 5/16"	11/16"	1 1/16"	d+1/16"	1.5d+1/2"
¾"	1 5/16"	1 5/8"	5/8"	1 5/16"	¾"	1 5/8"	13/16"	1 5/16"	d+1/8"	1.5d+5/8"
⅞"	1 5/16"	1 5/8"	¾"	1 5/16"	¾"	1 5/8"	13/16"	1 5/16"	d+1/8"	1.5d+5/8"
1"	1 5/16"	1 5/8"	¾"	1 5/16"	¾"	1 5/8"	13/16"	1 5/16"	d+1/8"	1.5d+5/8"
1 1/8"	1 5/16"	1 5/8"	¾"	1 5/16"	¾"	1 5/8"	13/16"	1 5/16"	d+1/8"	1.5d+5/8"
1 ¼"	1 5/16"	1 5/8"	¾"	1 5/16"	¾"	1 5/8"	13/16"	1 5/16"	d+1/8"	1.5d+5/8"
1 ⅜"	1 5/16"	1 5/8"	¾"	1 5/16"	¾"	1 5/8"	13/16"	1 5/16"	d+1/8"	1.5d+5/8"
1 ½"	1 5/16"	1 5/8"	¾"	1 5/16"	¾"	1 5/8"	13/16"	1 5/16"	d+1/8"	1.5d+5/8"
1 ⅝"	1 7/16"	2 1/16"	1 3/16"	2 5/16"	1 1/16"	2 5/16"	1 1/2"	2 5/16"	d+1/8"	1.5d+5/8"

PROPORTIONS OF T-SLOTS, WILLIAM SELLERS & CO.

been in use for the last four years, after having been slightly modified from a set of proportions adopted in 1883.

These proportions are based on the use of square-head bolts where the size of the head is 1½ times the diameter of the body plus ⅛ in. They represent three conditions: First, both parts of the slot, that for the head and for the body of the bolt, are finished; second, where both are rough, that is, unfinished cores; third, where the slot for the head is cored and that for the body of the bolt finished.

In the first two cases the two parts of the slot are, of necessity, concentric, and only a moderate amount of clearance is required. In the last case the two parts are almost certain to be out of parallel, and it is obvious that more side clearance must be allowed for the head. We, therefore, provide as much width as we dare without danger of allowing the head to turn. Our experience with these proportions has been on the whole satisfactory.

Approximate Indexing of Angles on the Miller

In Vol. 36, page 249, a description of what is termed "Approximate Indexing of Angles on the Miller," concludes by applying this method of indexing to cut a 101-tooth gear—a prime number. The author uses a 43 circle to accomplish this result, moving the crankpin 17 holes for each tooth.

First, let us find how many holes there are in a 43 circle multipled by 40. We have $43 \times 40 = 1720$ holes, and as he indexes 17 holes each time he cuts a tooth, we have $1720 \div 17 = 101.17647+$ teeth in the year, an error too great to tolerate. We can now see that we have 0.17647+ of a tooth too many in the gear.

Now, assuming that the gear to be cut was of one diametral pitch, we have an accumulated error of 0.555 in the circular pitch as follows:

$$\frac{17,467}{100,000} \times \frac{3.1416}{1} = 0.555 \text{ in. almost}$$

So, if the cutter passes through the first space cut, it will mill away 0.555 in. from the side of the first tooth, which would condemn the gear. As I have given the accumulated error of 0.555 in. for one diametral pitch, what would be the error on a 20-diametral pitch gear?

Dividing 0.555 in. by 20 = 0.02775 in. as error, and for a 32-diametral pitch gear we get $0.555 \div 32 = 0.01734$ in. as the error.

I do not see how it is possible to apply this method of indexing to gear cutting with any assurance that satisfactory work would result.

EDWARD J. RANTSCH.

Albany, N. Y.

College and Shop Discipline

Of what avail is it to talk about colleges and scientific discipline? And of what use is it to compare discipline for men working at a trade with discipline for boys who are developing their minds and bodies? Why discuss the matter of discipline at all? Why print the article on page 538?

So many critics of colleges and their product seem to overlook the fact that while the college has to handle and shape its product from the rawest kind of material, this material, nevertheless, is human and must be treated as such. And again many who discuss the subject of the faults of the college seem to believe that the average college boy—or man—spends a large part of his time in "high jinks" such we see exploited in the daily press.

Now those who have been connected with institutions of learning long enough to grow intimately acquainted with the real inside life of a college are generally impressed with the fact that students are a rather sober, hard-working set of fellows who have the very earnest purpose of getting an education. And when it is remembered that these are mere growing boys, full of life and the spirit of fun and play, it must be put down to their credit that they are so industrious, and serious minded.

As for discipline in the college compared to discipline in the factory it can only be called to mind that the only real discipline comes from the mind. When a man has mental control—and that is about all any college aims to give a man—he is his own master and the matter of discipline is solved.

It has been the experience of those who have college men to teach that the matter of discipline is best taken care of by assuming that every man is a gentleman and that the subject need not be thought about at all.

Coöperation is as essential in the classroom as it is in the shop and no one can get it by placarding the walls and bulletin boards with rules and regulations. Every man, whether working for wages or an education, wants to, and will, do what is expected of him if treated with consideration and respect.

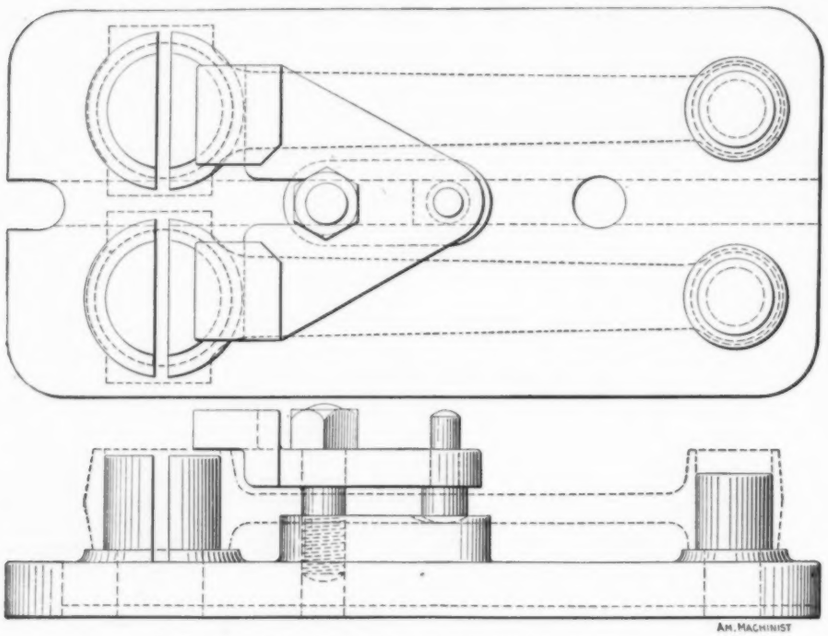
Iowa City, Iowa. F. G. HIGBEE.

Splitting Connecting Rods

Seeing C. E. Berg's article in Vol. 36, page 470, suggesting an improvement on the Doris Motor Car Co.'s method of splitting connecting rods, as described by F. A. Stanley, on page 84, brings to mind a fixture designed by me, which would prove much more efficient than either of the two mentioned.

The cut should be self-explanatory. The original design was to take two rods,

but any number may be handled in this manner. The rod is located on two pins; the small one is ground oval and the largest diameter set to stand at right angles to the keyway. This is to allow for variation of the center distances of holes in the rods.



FIXTURE USED FOR SPLITTING CONNECTING RODS

The large pin is slotted $\frac{3}{32}$ in. wide to take a $\frac{3}{32}$-in. saw and allow for the use of two $\frac{3}{32}$-in. feelers, or set-blocks, for setting up the fixture.

The clamp is slotted to easily slip off the bolt, and is made to hold down two rods at a time with one setting.

KINGSTON FORBES.

Bridgeport, Conn.

Marking Blueprints

The suggestions appearing in these columns recently for marking blueprints are very good, but I find two objections to using the bleaching compounds mentioned.

First, if I am in a hurry I get too much solution on my pen, which takes in other details than the ones intended, and makes other changes necessary. Second, the solutions are usually too thin to write with conveniently and the characters run together easily.

I have also used commercial white ink with poor results, as it is pale, fades rapidly and rubs off. By accident we hit on a very satisfactory solution. We had an old bottle that had contained white ink, but the liquid had evaporated, leaving a white, spongy deposit. To enable us to use this for marking, some soda solution was poured in, with surprising results. We found that we had a perfect ink, as the soda bleached the print, while the commercial ink gave it a good, clear body, which did not rub off or fade.

In marking prints we block out the figures, or section to be re-marked, with a blue pencil, and then, with this white ink, make the necessary corrections on the penciled space.

J. M. HENRY.

New Britain, Conn.

Local Selective Hardening

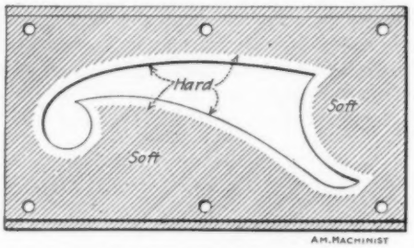
Reading in Vol. 36, pages 233-4, the article "Selective Hardening and Carbonizing," I would like to ask Mr. Shore what kind of fire paint he used; how many coats of it he applied to the steel to be hardened; if the paint is easily rubbed off when handling the die with a pair of tongs and if it is expensive.

I have successfully tried local hardening by covering the parts not to be hardened with thin sheet iron, about 0.010 to 0.018 in. thick.

To cover the die shown, take a piece of sheet iron 0.015 in. thick, new or old, but not galvanized, and cut it out with a chisel or shears as illustrated, making the blank in the iron $\frac{1}{8}$ in. larger than the one in the die, and bend the four sides down and under the die, covering the under side with a piece of iron having the same size hole as the top. The die thus packed will harden only $\frac{1}{16}$ in. around the hole; thus neither the top holes nor dowel-pin holes shrink in hardening.

The thread die should be covered the same way, only clearance between the threads inside the die should be covered up. The soft parts on the reamer should be covered with a sleeve of sheet iron and tied with iron wire to prevent the sleeve from opening up in the furnace. The gear should be covered with two sheet-iron washers on the sides and a sleeve inside the hole, with only the teeth uncovered; thus the teeth only are hardened.

The iron covers can be used over and over again and, as the holes cut out with a chisel can be left with rough edges, it will only take a few minutes to make such a box or covering.



THE PUNCH AND DIE

I would like to know why it is not more generally used and would appreciate the opinion of an expert hardener or steel man as to whether such hardening has any bad effect on the steel.

WALDEMAR KROLL.

New York City.

Automobile Cylinder Explosion

In the article discussing the automobile cylinder explosion, Vol. 36, page 431, your correspondent says in substance that there is only one other possible explanation than nitric acid, viz: That the exhaust valve refused to work. Had that been the case, and the intake valve still been in working order, as soon as it opened, what was left of the burned gases would have found an outlet through this valve and passed off through the air intake in the carburetor, instead of continuing to take in gas and explode, as he says.

The cylinders to take mixture must have a vacuum, not pressure. He also mentioned the possibility of the timing gear having slipped out, thus stopping the crankshaft. Had the timing gear slipped out, the crankshaft would have stopped, but only because the engine had died, and that being the case, I see no chance for an explosion in a dead engine.

The timing gears time the camshaft, and through it the lifting of the valves, so if the camshaft stops the valves stop and the engine dies for want of fuel, but there would be no more pressure in the cylinder than there is every compression stroke when in working order, and a great deal less than when the gas is exploded at the beginning of the stroke.

If the engine were of the T-head type, the exhaust of the burned gases would act as previously explained.

Butte, Mont. R. M. MCGREW.

A CONVENIENT TABLE OF STANDARD BOLTS AND NUTS WITH ABOUT ALL THE DIMENSIONS FOR EVERY NEED.

Diameter. Of Bolt.	Diameter. At Root of Thread.	Thread. Per Inch.	Thread. Length of.	Area. Of Bolt.	Area. At Root of Thread.	Strength at 17,500 Pounds. Tension 17,500 Pounds at Root of Thread.	Strength at 17,500 Pounds. Shearing 10,000 Pounds. Full Bolt.	Strength at 17,500 Pounds. Shearing 10,000 Pounds. At Root of Thread.	Strength at 10,000 lb. Tension 10,000 Pounds at Root of Thread.	Strength at 10,000 lb. Shearing 7000 Pounds. Full Bolt.	Strength at 10,000 lb. Shearing 7000 Pounds. Root of Thread.	Thickness. Head.	Thickness. Nut.	Short Diameter of Hexagon and Square.	Across Corners. Hexagon.	Across Corners. Square.	Weight of 100. Hexagons. Heads Pounds.	Weight of 100. Hexagons. Nuts Pounds.	Weight of 100. Square. Heads Pounds.	Weight of 100. Square. Nuts Pounds.	Steel. Weight of 100 Rods One Inch Long.	Depth of U.S.S. Thread. Single.	Depth of U.S.S. Thread. Double.
1/4	0.185	20	1/2	0.049	0.027	471	491	270	270	343	189	1/4	1/4	7/16	0.51	0.59	1.5	1.2	1.8	1.4	1.40	0.0325	0.0650
5/16	0.240	18	1/2	0.077	0.045	795	767	450	450	539	315	5/16	5/16	35/64	0.64	0.74	1.9	2.2	2.3	2.4	2.17	0.0361	0.0722
3/8	0.294	16	1/2	0.110	0.068	1,187	1,104	680	680	770	476	3/8	3/8	41/64	0.77	0.88	4	3.2	4.6	3.7	3.12	0.0406	0.0812
7/16	0.344	14	1 - 1½	0.150	0.093	1,633	1,503	930	930	1,050	651	7/16	7/16	23/32	0.90	1.03	5.6	4.8	6.8	5.6	4.25	0.0464	0.0928
1/2	0.400	13	1 - 1½	0.196	0.126	2,200	1,963	1,260	1,260	1,370	882	1/2	1/2	13/16	1.03	1.18	8.2	6.7	9.6	7.7	5.55	0.0500	0.1000
9/16	0.454	12	1 1/4 - 2	0.248	0.162	2,837	2,485	1,620	1,620	1,740	1,133	9/16	9/16	29/32	1.16	1.33	10.8	9	12.8	10.8	7.04	0.0542	0.1084
5/8	0.507	11	1 1/4 - 2	0.307	0.202	3,532	3,068	2,020	2,020	2,150	1,415	5/8	5/8	1 1/32	1.29	1.48	14.7	12	17	14.3	8.69	0.0590	0.1108
11/16	0.620	10	1 1/4 - 2	0.442	0.302	5,285	4,418	3,020	3,020	3,090	2,120	11/16	11/16	1 3/32	1.42	1.63	24	19.5	27.6	23.3	12.5	0.0650	0.1300
3/4	0.731	9	1 1/4 - 2 1/4	0.601	0.419	7,338	6,013	4,190	4,190	4,210	2,940	3/4	3/4	1 7/32	1.55	1.77	36.3	29.8	42	35.7	17.1	0.0722	0.1444
13/16	0.837	8	1 1/4 - 2 1/4	0.785	0.551	9,643	7,854	5,510	5,510	5,500	3,800	13/16	13/16	1 13/32	1.81	2.07	52.5	43	60	52.6	22.1	0.0812	0.1624
7/8	0.940	7	1 1/4 - 3	0.994	0.693	12,129	9,940	6,930	6,930	6,950	4,850	7/8	7/8	1 5/16	2.02	2.31	73	60	84	71.5	28.2	0.0928	0.1856
15/16	1.055	7	1 1/4 - 3	1.227	0.890	15,573	12,272	8,900	8,900	8,600	6,230	15/16	15/16	1 15/32	2.18	2.49	98	80	112.4	96.2	34.8	0.0928	0.1856
1	1.169	6	1 1/2 - 3	1.485	1.054	18,447	14,849	10,540	10,540	10,400	7,380	1	1	1 1/2	2.25	2.57	128	105.3	145	126.7	42	0.1083	0.2166
1 1/8	1.284	6	1 1/2 - 3	1.767	1.294	22,642	17,671	12,940	12,940	12,400	9,050	1 1/8	1 1/8	1 11/16	2.41	2.77	164	134	190	161.6	55.7	0.1083	0.2166
1 1/4	1.389	5½	1 1/2 - 3	2.074	1.515	26,511	20,739	15,150	15,150	14,500	10,600	1 1/4	1 1/4	1 7/8	2.88	3.33	202	166.7	235	206.7	58.7	0.1181	0.2362
1 3/8	1.491	5	1 1/2 - 3	2.405	1.745	30,522	24,053	17,450	17,450	16,850	12,200	1 3/8	1 3/8	2 1/16	3.17	3.66	255	206.6	295	256.4	68	0.1300	0.2600
1 1/2	1.616	5	1 1/2 - 3	2.761	2.049	35,858	27,612	20,490	20,490	19,300	14,350	1 1/2	1 1/2	2 1/4	3.46	4.00	306	252.5	355	313.5	78.2	0.1300	0.2600
1 5/8	1.712	4½	1 1/2 - 3	3.142	2.300	40,252	31,416	23,000	23,000	22,000	16,100	1 5/8	1 5/8	2 5/16	3.75	4.33	361	306.8	432	380.2	89	0.1444	0.2888
1 3/4	1.962	4½	1 1/2 - 3	3.976	3.021	52,873	39,761	30,210	30,210	27,800	21,200	1 3/4	1 3/4	2 1/2	4.04	4.62	526	434.8	609	540.6	112.6	0.1444	0.2888
2	2.176	4½	1 1/2 - 3	4.909	3.716	65,035	49,087	37,160	37,160	34,400	26,000	2	2	2 5/8	4.33	4.95	725	609.7	838	751.9	138.6	0.1625	0.3250
2 1/4	2.426	4	1 1/2 - 3	5.940	4.62	80,843	59,396	46,200	46,200	41,600	32,500	2 1/4	2 1/4	2 15/16	4.91	5.62	943	797.4	1,090	987.2	168.5	0.1625	0.3250
2 1/2	2.629	4	1 1/2 - 3	7.069	5.428	94,985	70,886	54,280	54,280	49,500	38,000	2 1/2	2 1/2	3 1/4	5.41	6.06	1,220	1,025.6	1,400	1,269	200	0.1857	0.3714
2 3/4	2.879	3½	1 1/2 - 3	8.295	6.509	113,911	82,958	65,090	65,090	58,100	45,600	2 3/4	2 3/4	3 7/16	5.77	6.47	1,535	1,290	1,770	1,597.5	235	0.1857	0.3714
3	3.100	3½	1 1/2 - 3	9.621	7.549	132,109	96,211	75,490	75,490	67,400	52,900	3	3	3 3/4	6.24	7.00	1,900	1,605.1	2,200	1,984.1	272.5	0.2000	0.4000
3 1/4	3.318	3	1 1/2 - 3	11.044	8.641	151,221	110,447	86,410	86,410	77,000	60,500	3 1/4	3 1/4	4 1/16	6.64	7.51	2,320	1,968.5	2,695	2,439	311.2	0.2166	0.4332
3 1/2	3.567	3	1 1/2 - 3	12.566	9.993	174,876	125,664	99,930	99,930	88,000	70,000	3 1/2	3 1/2	4 3/8	7.06	8.01	2,820	2,392.2	3,260	2,958.6	356.1	0.2166	0.4332

A Convenient Bolt Table

While there is very little new information in the accompanying table, it is usually necessary to consult several tables in order to find all that is given in this. This table was compiled with the idea of making it easier to find the needed information.

Broaches for Sizing Round Holes

By E. A. Ermold

More than a year ago the hand reamer, as a means of sizing and finishing round holes, was superseded in our shop by the broach, and since then a considerable saving has been effected in the cost per hole finished, and in addition the work produced has been so uniformly accurate that we are now able to manufacture our product on what is known as the interchangeable plan.

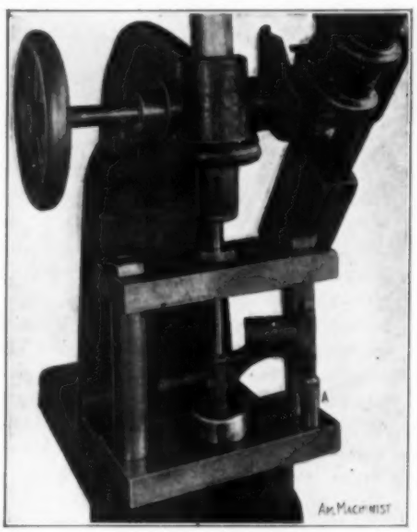


Fig. 1. The Subpress in Position in the Arbor Press

On about 50 per cent. of this class of work an accurate round hole is the starting point in the cycle of operations. In this connection when speaking of an accurate hole it is not amiss to state that the average reamed hole is very inaccurate when subjected to the critical inspection which our work now undergoes.

The principle involved in the broaching process is inherently more accurate for several reasons. In the first place it permits a more accurate method of presenting the work to the tool. To illustrate this, compare the manner of starting a hand reamer with the method shown in Fig. 1. The fixture shown is a subpress made very accurately and which, it will be noticed, is not subjected to any great stresses. The arbor press itself takes the strains and it alone is deflected when under the cutting strain. The function of the subpress is to guide

the broach and hold the work in alignment with it, the work being located by the previously reamed hole.

The subpress, with its interchanging bushings and adapters, is shown so clearly in Figs. 1 and 2 that a detailed description of the operation is not necessary. There are, however, a few details which it might be well to explain. These are shown in Fig. 3.

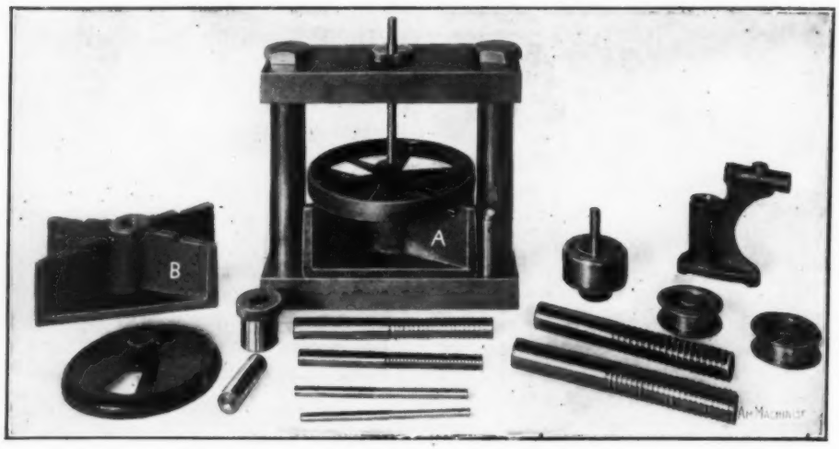


FIG. 2. THE TOOLS EMPLOYED AND THE WORK PRODUCED

The subpress was made wide enough between the posts to take our largest piece of work and high enough to take the tallest piece and by using the subbases shown at *A* and *B*, Fig. 2, shallow pieces could easily be operated on.

The method of guiding the broach and locating the work is shown in detail in Fig. 3. The grinding bushing *B* is a snug fit in *A*; *C* is the broach, the shank of which is smaller than the body; in practice it must be slipped into the bushing *B* before the latter is inserted in *A*. This procedure prevents injury to the cutting edges by being passed through a hard bushing. One end of the locating pin *D* fits the reamed hole in the work; the other end is made larger in diameter and fits a supporting block of hardened steel. The hole being larger than the broach allows it to pass through without the cutting edges coming in contact with it.

It will be noticed in Fig. 1 that the broach is not long enough to be forced through the work at one stroke of the ram; a pin is therefore placed on the broach at the second stroke to accomplish this. It was necessary to make the broaches short on account of the limits of the arbor press. This is an advantage when making the broaches as they are easier to make when short.

BROACHING AND REAMING COST COMPARED

The actual labor cost per hole when finished by the broaching method is slightly less than when hand reamed, but the greatest saving is in the tool cost. When reaming the holes we found that we could not ream 25 holes to size with one reamer, but we have been able to broach 5000 holes with one, half-inch broach and all the holes were up to plug gage size. This broach was made for less than five dollars, which is something less than the 200 reamers necessary for 5000 holes under the conditions mentioned, would cost.

PROPORTIONS OF THE BROACHES

Some of the important dimensions of these broaches are given in Fig. 4. It will be noticed that the first five or six teeth do most of the cutting. This is entirely different from designing a broach which is intended to remove considerable stock. In such a case each successive tooth throughout the whole length would remove an equal amount. It is very important that all broaches should be from 0.0002 to 0.0003 in. larger than the nominal size and the amount of land should be 0.012 in.

In order to get accurate holes with broaches it is very important that the preparatory work should be done accurately and uniformly. To this end we have had a set of undersize plug gages made, which gages are 0.002 in. less than standard. All holes are kept very close

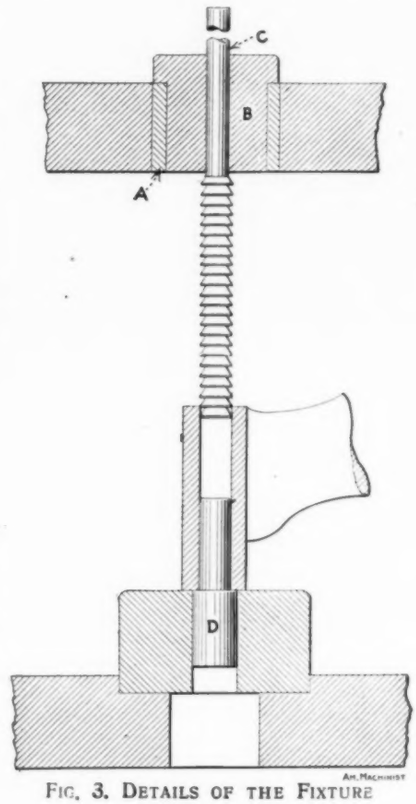


FIG. 3. DETAILS OF THE FIXTURE

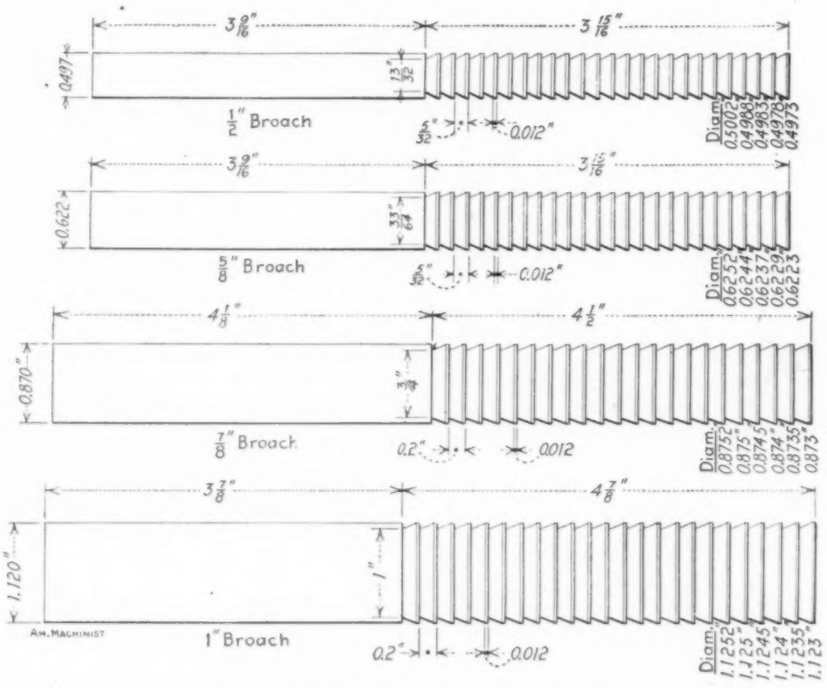


FIG. 4. PROPORTIONS OF ROUND BROACHES

to these. In this connection mention should be made of a fact which seems very odd. As I said before, after reaming a few holes in cast iron a ½-in. reamer was hopelessly below size. We have since discovered that these undersize reamers can be used in the turret lathe for a long time before they are too small for the undersize plugs. Of course a little more power is required to force them through the hole, but we have reamed over 500 holes with one of them before it was too small.

Making the Broaches

One of the most important factors contributing to the success of these broaches is the steel from which they are made. My attention was first called to this steel by an article published in the AMERICAN MACHINIST, Vol. 33, page 17. The analysis of this steel, which was also given, shows it to be entirely different from anything on the market today—over 2 per cent. of carbon and more than 14 per cent. of chromium.

This is startling to the average steel man and he will tell you it is impossible to combine such a large percentage of carbon in any steel. This steel hardens in oil at 1810 to 1820 deg. F., but on account of the high percentage of carbon, it must not be brought into contact with a gas flame, as it will thus be decarbonized. We use an oven gas furnace, placing the work in a piece of pipe which has both ends plugged with fireclay plugs luted with asbestos cement. We use lard oil for cooling and do not draw the temper of the broaches.

This steel will harden without any perceptible warping, perhaps two or three thousandths in eight in. of length, and consequently we leave only about 0.015 to 0.020 in. for grinding. When grinding, use a *wet grinder*, as it is impossible to grind anything like a true cylinder in a dry grinder, and the accuracy of a broached hole depends upon the truth of the cylindrical surface which is generated in the grinder. Be sure to grind *parallel* as any taper in the broach is fatal to success; especially is this so if it is larger toward the back. This gives a *negative* clearance on the lands and it will not work. The front of the teeth is ground, and also the angular portion back of the lands, in order to make all the lands a uniform width. For this work we use a 70-I alundum wheel, which is very satisfactory.

These broaches can be sharpened an indefinite number of times by revolving them in a lathe and holding a fine oilstone against the front face of the tooth. The principal materials on which they have been used are cast iron and phosphor bronze, both of which are very hard on reamers. Until the broaching method was used it was practically impossible to maintain a strict standard. Since using broaches our bill for hand reamers is very small.

If the possibilities of these broaches were fully appreciated throughout the manufacturing world they would be the means of an immense economy.

German Agitation Against American Machines

By William A. Viall*

The German nation is constantly pointed out as the nation that is making the most active campaign of any country in its efforts to obtain footholds for its products in foreign countries. The government takes an active part through its various branches to encourage the export business, and the merchants and manufacturers seem alive to the necessities of exporting in the fact that they are apt at learning the necessities of the foreign customers and in catering to them.

In view of this it does not seem possible that Germans could make such a mistake in their methods as has developed in the past year or two in a type of "Americaphobia" which has extended to some of the machine-tool builders.

As an industry, the machine-tool industry was not greatly in evidence in 1893. During the Chicago World's Fair German engineers of all classes visited America and were cordially welcomed on all sides. Following that time there was a large export of American tools to Germany. The Germans began to use more and more of the American methods in their shops and the machine-tool industry developed into a large and active business.

We all know that designs and workmanship have grown better year by year. The export of German machine tools has increased over import to a tremendous extent. In the year 1900 the German export of machine tools amounted to about 11,000 tons, and in 1908 to about 58,000 tons, falling to about 48,000 tons in 1909. In 1910 the money value was about $19,000,000. The imports in 1900 were about 7000 tons, falling to about 2000 tons in 1901, rising to about 9000 tons in 1906 and falling to about 5000 tons in 1909. (*Zeitschrift des Verein Deutscher Ingenieur* 1911).

German Combative Methods

With this splendid growth it seems all the more strange that a single country should be taken, as has America, to be the mark for a campaign of such an undignified character as that which is now being waged. Any good salesman is justified in setting forth the good points of the line that he is marketing, but when the argument turns upon the point that the goods are made by the nation of the prospective buyer and should be bought on that ground, the argument is not a strong one.

Furthermore, when a certain class puts forth a propaganda calling American competition "irresponsible" and founded on "bluff," a condition is apt to arise, and has arisen, that misleads many and is reflected in advertisements that state: "Not American advertising but German care, etc." "Many times superior to the original American manufacturer," "It is not in America that the largest factory exists," etc.

There is in many of the German papers, technical and daily, paragraph after paragraph calling attention to so called American business methods, and in a portion of the technical papers devoting themselves to machine-tool building the shadow over the trade appears to be the American business.

The main ground for this disturbance seems to be the United States tariff. This is brought forward time and time again, but as yet not one word from the German side has come under observation calling attention to the great difference between German and American rates.

At present the class of machine tools that is being imported by Germany is the class the labor cost of which makes up the greater part of the whole cost, and when the difference in cost of labor is as great as it is between Germany and the United States, no fair-minded person could find fault with the duty now imposed, as an unjustified protection.

A Shortsighted Policy

The German manufacturer is generally considered a business man who does not buy on sentiment but who purchases when and where he thinks he is getting the best he can for the money laid out. It would seem as though this class would not be flattered by the campaign now urged against it and would call attention to the danger that exists in a possible retaliation. As Germany is now selling us goods to the value of about $163,000,000, it would not be good business to jeopardize this large turnover.

One of the results of this Anti-American feeling was shown by the fact that last July the *Leipziger Neuesten Nachrichten* in a four-page supplement called attention to a proposed trip to be taken by a number of gentlemen who were to investigate the social, political and hygienic organization and welfare conditions, and warned manufacturers against admitting them to their works for the reason that they were using the nominal purposes of their mission as a cloak to cover their true mission, which was to spy—an ugly word—into German methods. In addition to this statement letters were published by different classes of manufacturers advising against the admittance of Americans to their works.

*Secretary, Brown & Sharpe Manufacturing Co.

No people have been more gladly welcomed to our American works, at least in the machine-tool industry, than have the Germans. May we not have from some of the technical papers an indication that the attitude that is so much in evidence in some circles is a false one and one that must work harm, in the final analysis, to the German people?

Portable Cylinder Boring Bar

By W. B. Hamilton

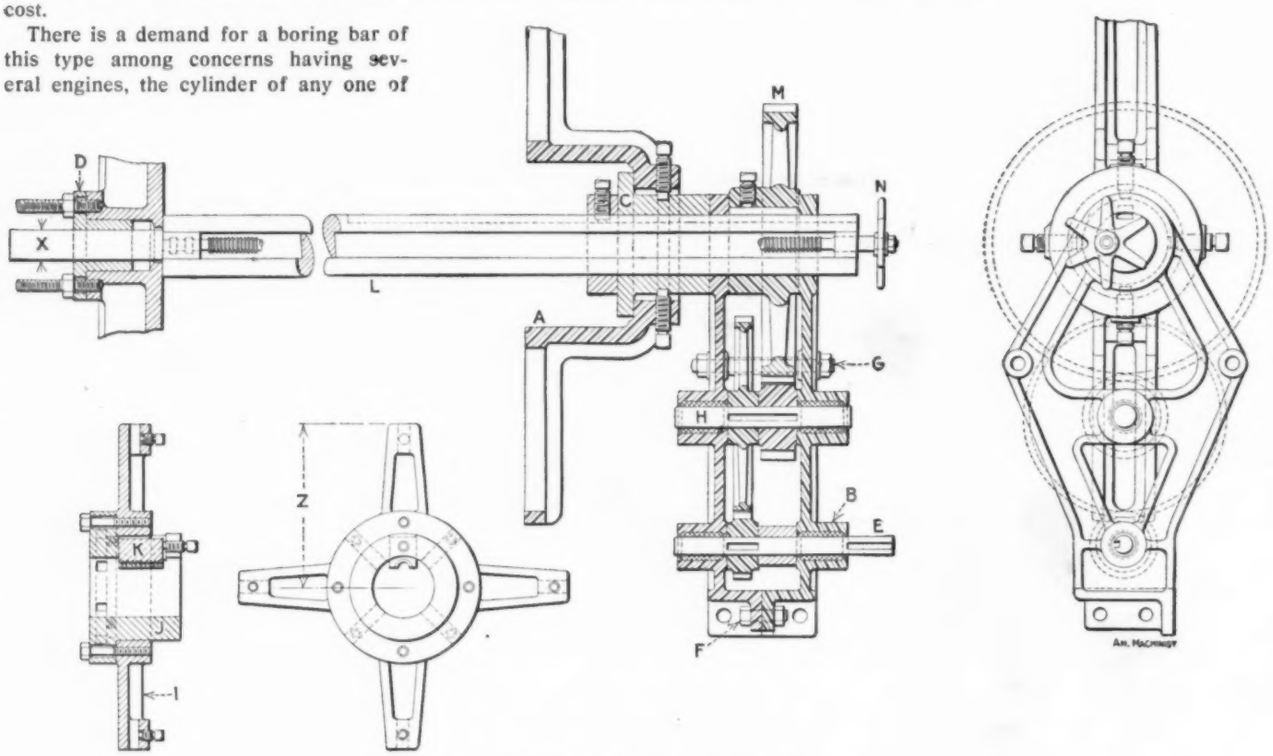
The following is a suggestion for a cheap and efficient portable cylinder boring bar. In designing this portable boring bar, no distinctly new features are made use of; an effort is made to show that a simple outfit can be made at very small cost.

There is a demand for a boring bar of this type among concerns having several engines, the cylinder of any one of which may require reboring. A concern with a small machine shop can build this outfit at a cost not much in excess of the cost of reboring one cylinder.

The drawing shows many of the parts as steel castings; this was done to reduce the transportation charges to a minimum. Where no extensive transportation is involved, parts *A* and *B* may be made of cast iron, thereby reducing the cost. *A* may be made to take care of cylinders ranging in diameter from 12 to 30 in., at a very small extra cost and weight. It is constructed as shown to give room for adjusting the cutting tools. To secure this bracket to the cylinder and cylinder-head studs are made use of; one stud on each side is found sufficient.

The adjusting bushing *C* is made of cast iron in order to give a better bearing. Four screws as shown are used for centering the bar. The other end of the bar is centered and provided with a bearing by the bushing *D*, that is fitted into the piston-rod stuffing box. The diameter *X* of this end of the bar is determined by the diameter of the piston rod of the smallest cylinder that is to be rebored. For a 12-in. cylinder it might be $2\frac{3}{16}$ inches, but to be on the safe side it is better to make it 2 inches.

The shaft *E* is extended and keyseated, and on this extension a crank or pulley may be placed for either hand or power driving the bar. With the gears shown it will be noted that to get one revolution of the bar, the shaft *E* must make 11.7 revolutions. This ratio will insure a steady cut in case the bar is driven by hand.



A Portable Cylinder Boring Bar

It may at first seem that the parts *B* are not stiff enough, but it is found that if the bolts *F* are fitted and both *G* and *F* pulled up tight, sufficient rigidity is obtained for all practical purposes. Bearings for the shafts *E* and *H* are shown babbitted; at a little greater cost brass bushings may be substituted.

For carrying the tools, a cutter head similar to *I* is suggested for boring all cylinders 14 in. and more in diameter. The dimension *Z* will depend on the cylinder diameter, one size head being used to take care of about two sizes of cylinders. In order to secure a steady cut and to avoid chattering, a four-tool spider should always be used.

The cutter head *I* is carried on the feed bushing *J*. This bushing takes the feed nut *K*, and is also so constructed that it may be used as a cutter head for boring out cylinders 11 and 12 inches in diameter. For feeding this cutter a 1-inch diameter feed screw with four square threads per inch will be found ample. For turning this screw the six-point starwheel *N* is used; this may be done either by hand or automatically, the preference being for the automatic. The inner end of this feed screw is shown turned down and several shoulders provided. It is then babbitted in place with a good hard babbitt. The outer end of the bar is drilled and a bearing provided for the screw as shown. This feed screw must be allowed to bear in the bottom of the slot in the bar. The feed nut *K* must be made of special brass with good wearing qualities.

The bar *L* should be of special open-hearth 0.50 per cent. carbon steel. If made about ten feet long it will generally be found of sufficient length to rebore a cylinder of 72-in. stroke. It is easy to determine the length of the bar required. The space required on the bar for parts *A*, *B*, *C* and *M* will be seen to be 19 inches. Add to this the distance from the front cylinder head to the head end of the cylinder, making an allowance of two or three inches, and you have about the necessary length required. In each case it should be determined whether or not the bar is long enough before it is shipped out of the shop. A cylinder as large as 36 inches in diameter may be rebored with this 4-in. bar, if a four-tool spider is used.

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OUTLINE OF TOPICS, PAGE 169

American Machinist

German Agitation Against American Machines

On page 807 we print an article under this title referring to some of the features of the agitation against American machines in Germany, particularly machine tools.

It is well known among American machine builders that this hostile feeling has been given frequent expression in print during the last two years. As a rule it has not been looked upon with alarm here, for any defensive agitation cannot last long when it has nothing tangible to oppose. Men may be gathered together to fight shadows, but they cannot be held together.

The "American Invasion" is no more real today than it has been at any time during the past fifteen years. Our import duty on machine tools, which is one ground for this disturbance, is 15 per cent. lower today than it was two years ago. The reduction was made at the request of American machine-tool builders. Thus there is no change in conditions to warrant the present agitation.

Quoting from the article referred to, "The German manufacturer is generally considered a business man who does not buy on sentiment, but who purchases when and where he thinks he is getting the best he can for the money laid out."

This states the economic law that governs buying and selling. Buy in the cheapest market, sell in the dearest. It is hardly likely that mere sentiment will ever cause business men of any nation to disregard this basic law.

If it is disregarded because of the argument, "You should buy home products," then you must pay home prices and accept home quality. Then logically one ought to buy his hats and shoes in his home town instead of in the nearby city at a more favorable price and of better grade. And one ought to get his groceries from his brother-in-law on the corner, and send his children to his cousin's private school. This would be patronizing home industries and buying home products.

Such a spirit is too narrow to be tolerated. It is false, absurd. It cannot prevail among a great people so wisely alive to economic conditions as are the Germans.

Another factor is the increasing cost of German-built machines. Wages are increasing in Germany. The cost of living is going up all over the world. Thus a great cost leveling process is at work. It is fair to assume that shortly the cost of the machines of the same grade, whether American built or German built, will be practically the same. The tendency of this will be to break down artificial barriers as sentiment.

Again the political situation in Europe is always tense. The countries there are jealously watching each other, fearing that a rival may get some advantage. It may be that this jealous attitude is partly the cause of this agitation. Having nothing to fear from us politically, a scare is attempted from our trade competition. For the very reason that this agitation comes from a false attitude, a disregard of the great economic laws governing trade, it cannot last long or have much final effect.

While it is not pleasant to the persons who are attacked, there is not the slightest disposition to retaliate in like manner. We recognize that the attitude is false and will disappear when it has run its course. The sooner this is done, naturally the better we will be pleased.

Yet we must not forget that there are busybodies in every nation. We have them as well as our German friends. The unwisely patriotic American may see danger in a fancied German invasion—he has raised the bogie of Japanese aggression frequently during the last two years—in the same way that his German friend looks for an American one, which merely shows that no one has a monopoly on agitation.

Statistics of Metal Working Machines

A request addressed to the Bureau of the Census for statistics concerning the manufacture of machine tools and metal-working machinery as a distinctive industry, brings out the fact that although an attempt was made to collect this information in connection with the census of 1909 the results were unsatisfactory.

There are apparently three principal reasons for this situation which must be put directly up to the manufacturers. The bureau did what it could, but was seriously hampered by conditions in the industry.

The three reasons are: The failure of firms building metal-working machinery and other lines to keep separate accounts; the lack of a generally accepted definition for "machine tool;" a failure on the part of some manufacturers to coöperate with the bureau in furnishing the desired information.

The desirability of collecting and publishing such statistics needs only to be mentioned to be recognized. In fact, the National Machine Tool Builders' Association requested that a special schedule covering its product be included in the census of 1909. It was in deference to this request that an attempt was made to collect statistics of metal-working machinery.

It is, therefore, reasonable to request manufacturers who are building metal-working machines and other lines to so arrange their bookkeeping methods as to be able to separate the figures in regard to the production of the various classes. If this is done the first difficulty which the census enumerators met with will be eliminated.

The matter of a definition of "machine tool" has been taken up in these columns a number of times. Such a definition is desired for customs purposes, as an aid in defining membership in the association and, here, as furnishing an intelligent basis for preparing a schedule in further censuses of manufactures. What is wanted is a clean-cut definition which can be generally accepted by all parties interested, not merely an arbitrary classification.

As to the third difficulty, it should be necessary to say but little. It is possible that the failure of some firms to

render reports was because of an inability to do so, rather than from a disposition to evade responsibility. If it is once appreciated that these statistics have real value to the industry as a whole, we cannot conceive of any manufacturer withholding them. It is more than likely that the "second time around" will be productive of better results than the first.

Congress of the Association for Testing Materials

We previously announced the forthcoming Congress of the International Association for Testing Materials, to be held in New York City during the first week of September. An American committee has been actively at work for nearly a year in making preparations for what is hoped will be the most successful congress that has ever been held.

It is expected that some 150 professional papers will be presented, many of them from foreign engineers and scientists. A bulletin just received lists sixteen of these foreign papers, giving a brief abstract of each.

A number promise to be of interest to machine designers and builders. One entitled,"Investigations of Bearing Metals for Machines," yields the following conclusions:

> The temperature at which bearing metals are used seems to have a distinct influence on the resistance to wear; the Brinell hardness number may give indications of the wearing qualities; the only mechanical tests of bearing metals having practical value are the hardness test, impact tests giving indications of brittleness, and such tests in gradual compression as measure the value of the metal for supporting working loads.

Other papers that from the title and abstract promise to be of interest to machinery builders are: "Practical Determination of the Viscosity of Lubricating Oils"; "Nature and Practical Applications of the Welding of Iron and Steel"; "Nature and Practical Applications of Autogenous Welding of Iron and Steel"; "The Fatigue of Metals".

If the ratio shown by the abstracts in this bulletin is even approximately held, there will be a large number of papers presented to the congres, dealing with subjects having direct application in the machine-building field.

The committee in charge of arrangements desires to have considerable discusion at the various sessions of the kind, and in the spirit, common in the conventions of the great American engineering societies. Thus, pertinent discussion is invited.

It is earnestly hoped that engineers, designers and machinery builders will consider it a privilege to prepare such discussion of papers relating to subjects in their field.

Chamber of Commerce ot the United States of America

The National Commercial Conference held in Washington, D. C., on April 22 and 23 resulted in the formation of a permanent organization to be known as the Chamber of Commerce of the United States of America. Between 600 and 700 delegates were in attendance representing every commercial interest and every section of the country. The preliminary suggestions of the Department of Commerce and Labor were broadly followed.

The object of the association is to provide a national clearing house for the development and consideration of business opinion and to secure united action upon questions affecting the commercial interests of the United States. Only questions of national importance are to be considered.

The eligible membership is to include every commercial or manufacturer's association not organized for private purposes. Each association is to pay annually in advance $25 for each delegate to which it is entitled. The number of delegates to the chamber is dependent upon the number of members in the association.

This general plan should receive careful attention from all commercial bodies in the country. A central office has been established in Washington, D. C., and can be addressed as the Chamber of Commerce of the United States.

Machinery Schedule of Cummins Tariff Bill Amendment

Senator Cummins, of Iowa, has introduced an amendment to the metal schedule of the Underwood Tariff Bill, which proposes to increase the rates of that bill materially with a single exception, yet considerably reduces the present duties. The paragraph dealing with machinery is given below, together with the rates of the Underwood bill.

> Cash registers, sewing machines and typewriters, 15 per cent. ad valorem (in the Underwood bill, free of duty); jute manufacturing machinery, linotype and all typesetting machines and printing presses, 20 per cent. ad valorem (in the Underwood bill, jute machinery 25 per cent., others free); machine tools and steam engines, 25 per cent. ad valorem (in the Underwood bill former free, latter 25 per cent.); embroidery and lace-making machines, including machines for making nets or nettings, 30 per cent. ad valorem (in the Underwood bill 25 per cent.).

In the present tariff law all of the above listed machinery is dutiable at 30 per cent. ad valorem, with the exception of embroidery and lace-making machines, which are dutiable at 45 per cent. ad valorem.

Personals

H. W. Kreuzberg, president of the Champion Tool Works Co., Cincinnati, O., will sail for Europe on May 25 for a four months' business trip.

Fred G. Schenkel, formerly connected with the Hess Steel Casting Co., has associated himself with the sales force of the Treadwell Engineering Co., Easton Penn.

George W. Randles, vice-president of the Foote-Burt Co., Cleveland, O., recently sailed for a European business trip calculated to extend about four months.

P. S. Catmur, manager of C. W. Burton, Griffith & Co., London, England, who has been in this country for a few weeks, sailed for home from Boston on May 14.

J. J. Moore, until recently mechanical engineer for A. P. Witteman & Co., Philadelphia, Penn., has become associated with the sales department of the Swind Machinery Co., Philadelphia, Penn.

Ralph R. Nickerson, formerly engineer with the Geo. F. Blake Manufacturing Co., East Cambridge, Mass., has joined the sales engineering staff of the Cleveland office of the International Steam Pump Co.

Perry J. Freeman, until recently superintendent, mechanical department shops, University of Illinois, has accepted the position of assistant manager of the regulator department, H. Mueller Manufacturing Co., Decatur, Ill.

Henry M. Lane, co-editor of *Woodcraft and Castings*, has resigned in order to devote his entire time to consultation work in foundry practice. For the present Mr. Lane's address will remain the Caxton Building, Cleveland, O.

John S. Alcorn, who has been with the Brown & Sharpe Manufacturing Co., Providence, R. I., for the past three years, has resigned to accept the position of mechanical superintendent of the American Watch Tool Co., Waltham, Mass.

John Harland Nelson has been elected professor of applied mechanics by the trustees of the Worcester Polytechnic Institute, to succeed the late Prof. Edward L. Hancock. Prof. Nelson has been at the head of the department of applied mechanics, Case School of Applied Science, Cleveland, Ohio.

W. D. Weaver, has retired from active work as editor of the *Electrical World*, although he will continue to devote some time as consulting editor. Mr. Weaver began editorial work in 1893 as editor of the original *Electrical World*; later he was editor of the *American Electrician*," which he helped to found. Upon the consolidation of the *Electrical World* and the *Electrical Engineer*, Mr. Weaver and T. C. Martin became editors of the combined journal, which is the present *Electrical World*.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

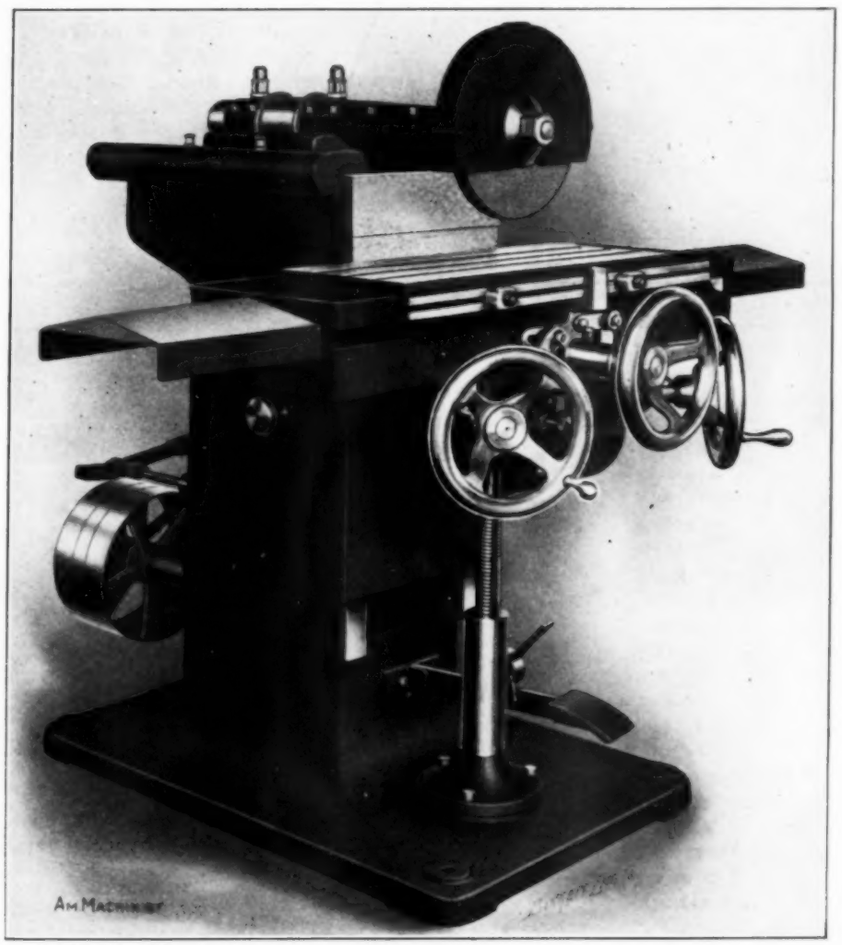
Automatic Surface Grinder

The halftone shows an automatic surface grinder built by the Northampton Emery Wheel Co., Leeds, Mass.

The base and box-shaped column of this machine are a single heavy casting. The head which carries the abrasive wheel works in slides on the upper part of the column and is provided with both hand and automatic crossfeed, the latter all of which are 10 in. wide. The table is driven by spiral rack and pinion.

The driving and feeding mechanism is all inside the column, but readily accessible. The parts are oiled by compression grease cups on the outside of the machine, the lubricant being led to the various bearings by copper oil piping.

The three handwheels in front control the knee, the crossfeed and the long



AN AUTOMATIC SURFACE GRINDER

is adjustable from 1/64 to 1/8 in. per table stroke. The knee which supports the table is fitted to wide bearing surfaces on the front of the column. It is provided with a heavy elevating screw graduated to read in thousandths.

The machines are built with three different lengths of table, 24, 30 and 36 in., feed, the two latter being used when setting the work on the table.

The table drive is of the planer type and gives a very smooth, shockless reverse. The foot lever in front of the base permits the machine to be stopped or started instantly. The foot lever is conveniently located.

Durant Counter

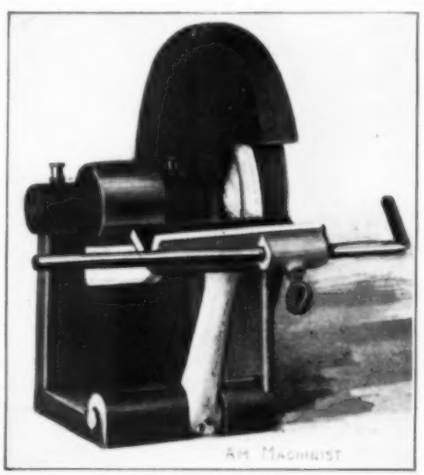
The counter shown provides a row of figures for recording totals of operations, and another for tallying short runs or parts of a complete run. The figures in the totalizer cannot be reset without unlocking the lid of the case, while the shorter row can be reset to zero instantly by a single turn of the large thumb-nut at the left of the case.

DURANT MODEL E COUNTER

It is made with two forms of the resetting device, both of which are included within a single case in this new model, which is known as model E. The counter is a recent product of the W. N. Durant Co., Milwaukee, Wis.

Abrasive Metal Saw

The machine shown was designed primarily for use in the toolroom for cutting off high-speed and other hardened tool steel.



ABRASIVE METAL SAW

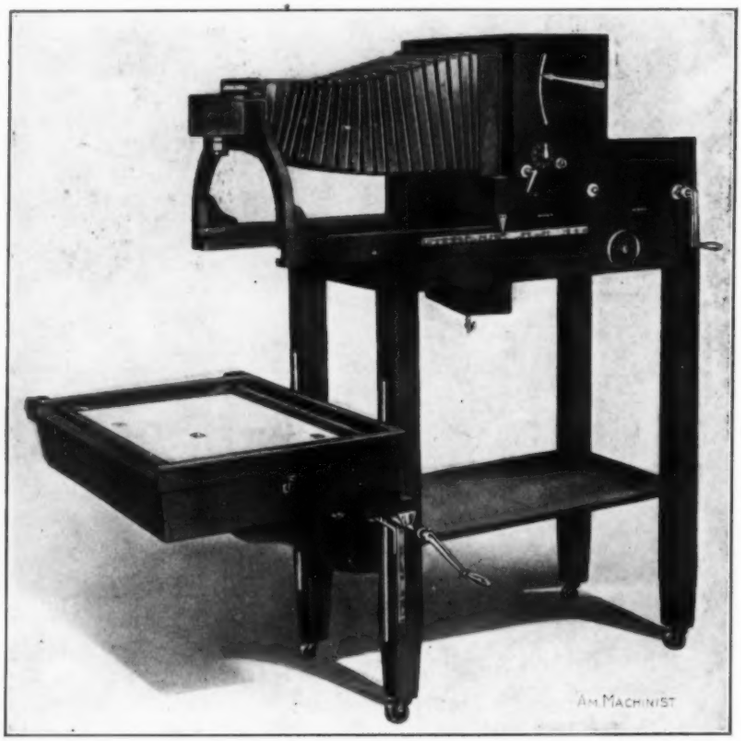
The cutting wheel is 8 in. in diameter, $\frac{1}{16}$ in. thick and an adjustable gage is provided for small duplicate work. It has a capacity for square bars up to $\frac{7}{8}$ in., and angles, channels, T's, etc., up to $1\frac{1}{4}$ in.

This machine was recently developed by the Peter Bros. Manufacturing Co., Algonquin, Ill.

A Simplified Photographic Copying Machine

The halftone shows a new model rectigraph built by the Rectigraph Co., Rochester, N. Y., to supply the demand for a less elaborate machine for copying plans, etc., than that described and illustrated in Vol. 35, page 1193.

In general principle this machine is similar to the one referred to, but occupies less space and is not so rapid. The copy-holder will handle books 19x28 in. and loose records $17\frac{1}{2}$x$25\frac{1}{2}$ in.



A PHOTOGRAPHIC COPYING MACHINE

In general the working of this machine and the results obtained are similar to those obtained with the standard machine.

Using the Outline of Topics

BY H. A. CHURCH

One of the valuable little things done by the AMERICAN MACHINIST during the past year is the introduction of the "Outline of Topics," and also the placing of it in the same position in each issue. While the index which you issue every six months is particularly complete, the "Outline of Topics" forms an excellent temporary index, which enables me to know exactly what is in each issue of the paper without any indexing of my own.

I am removing the pages containing this outline and fastening them together in their proper order, so that I can easily see at a glance exactly what has appeared since the last index was issued. It is a greater convenience than might be imagined.

The value of any paper to its readers depends very largely on the habits of the reader. I find it valuable to first glance carefully over the "Outline of Topics," so as to decide in a general way which of the articles interest me particularly; then I look over the synopsis at the head of the article and if this indicates that it contains information in which I am interested, I proceed to read the article itself.

In addition to this, I always endeavor to look over the paper with a view of seeing what is interesting to me, although I do not attempt to read everything in it any more than in the paper I buy every morning. If mechanics generally would form the habit of looking over a good technical paper with the same care they devote to the daily, becoming fairly familiar with the contents from the headings and only going into detail when the subject is of particular interest to them, I am sure that the average mechanic would be much better informed on general topics pertaining to his trade than is now the case.

I enjoy the baseball news of the daily, but I also try to realize that this is simply the recreation part of the day, and that the bread and butter, to say nothing of the pie and ice cream, come from my knowledge of the building of machinery. Then, too, the "Outlines of Topics" is one of the greatest conveniences in keeping a card or other index of special articles, as I occasionally do.

Determining Planer Speeds

BY D. K. BEAN

I have been interested for a long time in making time studies on various machine tools, and I think that all will agree with me that the planer is the most difficult to estimate on and the one machine on which the least information appears in the various articles on the subject. There are two or three methods I have used to good advantage on this work.

The first thing to determine is the cutting speed and the return speed in feet per minute. To find this quickly, arrange some fixed point convenient to the table, a stick in the tool post is as good as anything; set the dogs at full stroke and start the machine. Then with your stop-watch and a piece of chalk make a mark on the table and in exactly five seconds make another mark. Do this on both cutting and return strokes and the distance traveled in inches in five seconds is the speed of the table in feet per minute, because five seconds is the same fraction of a minute that one inch is of a foot.

TABLE OF CUTTING SPEEDS AND TIME FOR PLANERS

Speed in feet per minute	Time in seconds per foot	Speed in feet per minute	Time in seconds per foot
10	6	105	0.571
15	4	110	0.545
20	3	120	0.5
25	2.4	130	0.461
30	2	140	0.428
35	1.72	150	0.4
40	1.5	160	0.375
45	1.333	170	0.353 +
50	1.2	180	0.333
55	1.09	190	0.316
60	1	200	0.3
65	0.923	220	0.273
70	0.857	240	0.25
75	0.8	260	0.23
80	0.75	280	0.214
85	0.705	300	0.2
90	0.665		
95	0.631		
100	0.6		

Let us suppose that the figures give a cutting speed of 40 ft. and a return speed of 95 ft. per minute, and assume a piece requiring a stroke of 6 ft., a width of 10 in. and a feed of $\frac{1}{8}$ in.

Referring to the table we find that it takes 1.5 seconds to travel one foot at a speed of 40 ft., and 0.631 second to travel one foot at 95 ft.

Therefore,

40 ft. = 1.5 sec.
95 ft. = 0.631

2.131 sec. per ft.
6

12.786 sec. per stroke
80 width × feed

60)1,022.880(17.04 minutes

While this method is not theoretically correct on account of belt slippage at either end of the stroke, it is much closer than sizing up the job, looking wise and trying to remember how long it took to do it the last time.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

Metal Working

NEW ENGLAND STATES

The Fellows Gear Shaper Co., Springfield, Vt., is about to build an addition to its plant, increasing the size about 20 per cent.

The Remington Garage, 7 Remington St., Cambridge, Mass., was damaged by fire, Apr. 30. Loss, $10,000. John D. Cameron is proprietor.

The Martin Motor Car Co. is having a large garage constructed, at Norwood, Mass. It is expected to be ready for occupancy about Sept. 1, and will be used as an adjunct to the company's Franklin garage.

Charles H. Andrews will erect a large garage on Cherry St., Spencer, Mass.

S. E. Raymond, Springfield, Mass., will erect a garage, on Warren St., to cost $3500.

The Napier Saw Works, Springfield, Mass., will build a new factory.

Winslow H. Robinson, manufacturer of tin and sheet metal, Worcester, Mass., will erect a new factory, on Prescott St. It will be three stories high, 62x160 ft., mill construction.

The Palace Auto Station, 348 Trumbull St., Hartford, Conn., will double its capacity. The repair shop will also be improved and enlarged.

C. A. Small, of Norwich, Conn., who recently purchased the Holt house, at the corner of Main and Church Sts., New London, Conn., is having the building razed and will build a modern garage on the site.

Andrew J. Sloper will erect a garage to cost $1000, on Russell St., New Britain, Conn.

The Bristol Co., Waterbury, Conn., manufacturer of recording instruments, etc., will erect a one-story addition to its plant.

The American Brass Co., Waterbury, Conn., has awarded the contract for the erection of a new plant. Three buildings will be erected on Washington Ave., one four stories high, 42x152 ft., one three stories high, 42x57 ft., and one one story high, 42x50 ft. All will be of brick construction. Noted Apr. 25.

MIDDLE ATLANTIC

Work has been commenced on the erection of a garage on a 50x100 ft. plot on Sixth Ave., between Fifty-sixth and Fifty-seventh Sts., Brooklyn, N. Y. The building will accommodate 40 cars. Walter K. Peek is the proprietor.

The factory of Silver & Co., manufacturers of kitchen utensils, 308-314 Hewes St., Williamsburg, Brooklyn, N. Y., was damaged by fire, May 7. Loss, $30,000.

The Strong Steel Foundry Co., Main and Amherst Sts., Buffalo, N. Y., has let the contract for the erection of a foundry in Hertel Ave. Noted Apr. 18.

The Baker Bros. Motor Co., 846 Main St., Buffalo, N. Y., has commenced work on the construction of a new building.

The Johnson Harvester Co., Batavia, N. Y., is completing plans for extensive additions to be made to its plant.

The Motor & Mfg. Co., manufacturer of patent mufflers for automobiles and marine engines, Geneva, N. Y., will move its plant to Dunkirk, N. Y.

The contract has been let for the construction of a 60x100-ft. garage for William Rouse, Jr., William J. Walrad and G. Smith, of Herkimer, N. Y. The building will be of concrete-block construction, one story high.

A garage and automobile repair and paint shop is to be erected soon, in Lowville, N. Y., by Ira Gallup. The building will be 50x65 ft., of cement blocks.

Pefer Lammerts, Niagara Falls, N. Y., will award contracts at once for the construction of a 100x48-ft. garage at an estimated cost of $8000. The building will be of fireproof construction and will accommodate 25 cars.

The Syracuse Safe Co., East Water St., Syracuse, N. Y., will build a three-story and basement factory. Taber & Baxter, Gurney Bldg., are the architects.

The engine factory of Barber Bros., Syracuse, N. Y., was damaged by fire, May 3. Loss, $8000, covered by insurance.

The Trojan Machinery Co., Troy, N. Y., recently incorporated, will establish a plant for the manufacture of machinery and tools. The directors of the company are Clark H. Foster and Charles H. Aldrich, Troy, and William H. Tolhurst, Pittsfield, Mass.

The Victor Milling Co., Troy, N. Y., has had plans prepared for the construction of a new flour mill. It will be three stories high, 100x100 ft.

E. A. Watts is constructing a 50x80-ft. garage at the corner of Main St. and Pierce Ave., Manasquan, N. J.

A garage, to cost $40,000, will be erected at Bethlehem, Penn., by W. M. Applegate.

The Ajax Metal Co., 46 Richmond St., Philadelphia, Penn., has purchased a site on Orthodox St., and will soon commence the construction of a plant.

H. H. Harrison, Lafayette Bldg., Philadelphia, Penn., will erect a garage, 2½ stories, 38x34 ft., at Devon, Penn. The contract has been awarded.

Mitchell Bros. have purchased the public garage on Sixty-first St., between Girard and Haverford Ave., Philadelphia, Penn., and will make extensive improvements.

The Pittsburg Piping & Equipment Co., 3422 Smallman St., Pittsburg, Penn., has awarded the contract for the construction of a steel and corrugated-iron machine shop, to be erected on Smallman St. The estimated cost is $14,000.

The American Foundry & Construction Co., Hazlewood Ave., Pittsburg, Penn., has purchased property at Second Ave. and Longworth St., and will soon begin the construction of a new plant.

Two garages will be constructed at Port Allegheny, Penn. One will be built by C. C. Wagner, on South Pearl St., and the other will be erected by Pomeroy, Bard & King, on the lot opposite the Sartwel House. Both are to be constructed of cement blocks.

Work has recently been started on the 65-ft. addition to the building of the Eureka Motor Car Co., at Scranton, Penn.

SOUTHERN STATES

The Virginia Railway & Power Co., Norfolk, Va., has let the contract for the erection of a large power house to the Virginia Bridge & Iron Works.

Harry L. Alexander will erect a garage at Norfolk, Va., to cost $3000.

The Arbogast Motor Co. will erect a garage, at Asheville, N. C., to cost $10,000.

J. P. Setzer, Lincolnton, N. C., has purchased the factory of Brown Bros., at Elkin, and will equip it for the manufacture of gasolene engines.

The Purcell Auto Garage, 38 Auburn Ave., Atlanta, Ga., was damaged by fire to an extent of $40,000.

The shops of the Georgia, Florida & Alabama Ry. Co., at Bainbridge, Ga., were damaged by fire, May 1. The roundhouse and machine shop were totally destroyed.

The Florida Metal Products Co., Jacksonville, Fla., has awarded the contract to erect a plant, 50x200 ft.

The Dimmick plant of the United States Cast Iron Pipe & Foundry Co., North Birmingham, Ala., will be rebuilt, at a cost of $55,000.

The Watkins Foundry Co., Hattiesburg, Miss., has started work on its new plant.

The Ashland Steel Co., Ashland, Ky., will largely increase its capacity during the next two months. Included in the list of improvements is the installation of additional engines, the purchase of five electric cranes and the addition of special iron-working equipment. L. R. Putnam is the general manager.

Howard Lothrop, of the Lozier Co., of Louisville, Ky., will be in the market for machinery for an automobile repair shop as soon as permanent quarters for the company are secured. The company is now at 708 West Broadway.

The Louisville Axe & Tool Co., which has a large plant at Highland Park, Ky., is considering installing additional machinery and making a number of other improvements. The equipment will be contracted for in 90 days.

MIDDLE WEST

The Jischke Mfg. Co., Bellevue, Ohio, has let the contract for a new one-story factory, 50x150 ft., to manufacture ditching machines and corn harvesters.

The Ferro Machine & Foundry Co., Cleveland, Ohio, is erecting a new plant.

George W. Edmondson, of 2362 Euclid Ave., Cleveland, Ohio, doing general garage and repair business, is erecting a new garage.

L. F. McGrath, Cleveland, Ohio, has leased a site at Superior Ave., near East 12th St., and will erect a garage, to be used for repairing and storing automobiles.

The Cleveland Frog & Crossing Co., Cleveland, Ohio, maker of railway crossings, switches, etc., will build an addition to its plant.

The Cincinnati Pulley Machine Co., Cincinnati, Ohio, has increased its capital stock from $25,000 to $75,000, and will soon make extensive additions to its new plant in Covington. Noted Apr. 18.

The Lauth-Jurgens Co., Fremont, Ohio, has awarded the contract for the erection of a building, 60x200 ft. Noted Apr. 25.

The John W. Brown Mfg. Co., Center and Town Sts., Columbus, Ohio, manufacturer of carriage lamps, will build a factory at 133 South Center St., to cost about $14,000.

The Bowler Foundry Co., 1668 Columbus Road, Cleveland, Ohio, has prepared plans for the erection of a large addition to its plant for the manufacture of machine castings.

The American Rolling Mill Co., Middletown, Ohio, contemplates the addition of two new buildings.

The Pittsburg Foundry & Machine Co., Salem, Ohio, was damaged by fire, Apr. 30.

The Silver Mfg. Co., Salem, Ohio, has erected a one-story brick extension to its plant, 95x190 ft., to be used as an erecting room and blacksmith shop to manufacture machinery implements.

The Robbins & Myers Co., Springfield, Ohio, manufacturer of electric fans, has let the contract for the erection of a four-story addition, 100x160 ft., to its plant.

The Sandusky Foundry & Machine Co., Sandusky, Ohio, was damaged by an explosion. A new foundry mill will be erected.

The Silica Northern R.R. Co., Toledo, Ohio, will make some additions to its car-repair equipment.

The Imperial Mfg. Co., maker of sewing machines, is considering a proposition to remove its plant from New York to Evansville, Ind.

The Pennsylvania R.R. Co., Indianapolis, Ind., will erect a roundhouse to cost $200,000. J. W. Coneys is the superintendent.

The Marion Motor Car Co., Indianapolis, Ind., has been reorganized. The concern is controlled by J. I. Handley, president of the American Motors Co., of Indianapolis, who announces that a large plant will be erected.

The Superior Machine Tool Co., Kokomo, Ind., will erect an addition, 70x300 ft.

The Ross Gear & Tool Co., Lafayette, Ind., has selected a site for its new factory for the manufacture of steering gears for trucks. The new plant will contain 50,000 sq.ft. of floor space.

The United Wire & Steel Co., Battle Creek, Mich., will erect a one-story factory addition, 35x120 ft. M. P. Carny is the architect.

The Newman-Lane Co., automobile dealer, Detroit, Mich., is erecting a large addition to its present garage and repair shop, and new machine equipment will be needed.

The Murphy Iron Works, Detroit, Mich., has awarded the contract for foundations, including Raymond concrete piling, of a new foundry building to be erected at the foot of Walker St, to the Raymond Concrete Pile Co., New York and Chicago. George W. Graves is the architect.

The American Brass & Iron Co., Detroit, Mich., manufacturer of brass goods and auto parts, is erecting a new factory.

The Parrish Manufacturers Co., Reading, Penn., manufacturer of automobile frames, is erecting a large plant in Detroit, Mich.

The Tessmer Machine & Tool Co., Detroit, Mich., is building an addition to its factory.

The Jeffrey-Dewitt Co., Detroit, Mich., manufacturer of spark plugs, contemplates increasing its facilities by the construction of a two-story addition, 40x100 ft., which will be devoted exclusively to the manufacturing of porcelains for spark plugs.

The Reo Motor Car Co., Lansing, Mich., will erect two additional buildings to its plant.

The Eddy Paper Co., Three Rivers, Mich., is erecting a one-story machine shop, 50x70 ft.

The Stover Mfg. Co. and the Stover Engine Works, Freeport, Ill., are perfecting plans for a joint building, to be erected in East Freeport.

Fire damaged the machine shop of A. A. Tower, Rockford, Ill., to the extent of $3500.

The Oliver Typewriter Works, Woodstock, Ill., has awarded the contract for an addition.

Chas. Wright will erect a one-story garage, 24x24 ft., at Milwaukee, Wis. P. M. Christianson is the architect.

Herman J. Esser, Camp Building, architect, is receiving bids for the construction of a one-story and basement factory, 210x610 ft., for the Milwaukee Corrugating Co., Milwaukee, Wis. It will be of concrete and steel and will cost about $90,000.

The I. B. Rowell Co., Menominee Falls, Wis., manufacturer of farming implements, has decided to move its plant to Waukesha, Wis. Samuel Breese, Jr., is the president.

The Racine Economy Spring Co., Racine, Wis., will erect a four-story mill construction addition to its plant to cost about $8000.

The Wausau Iron Works, Wausau, Wis., is erecting an addition to its plant.

WEST OF THE MISSISSIPPI

The Tuttle Mfg. Co., Oakfield, Iowa, manufacturer of farm implements, contemplates the establishment of a factory, at Creston, Iowa.

The Armstrong Mfg. Co., Waterloo, Iowa, has acquired a site at Cedar Rapids, Iowa, and will erect a factory for the manufacture of gas engines. J. E. Armstrong is president.

The Kemp Bros. Automobile Co., Minneapolis, Minn., contemplates the erection of a $50,000 electric charging and service station at 1917-1923 Hennepin Ave.

The Spaulding Automobile Co., Aberdeen, S. D., will erect an addition, 50x42 ft., to its garage, in Aberdeen.

The King Foundry Co., St. Joseph, Mo., contemplates the construction of additions to its plant.

Z. T. White, El Paso, Tex., is having plans prepared for the construction of a garage on West San Antonio St. It will have a capacity for about 30 automobiles.

Harry Brown is installing a machine shop at Hearne, Tex.

WESTERN STATES

The Dickson Automatic Governor Co., Salt Lake City, Utah, is building a factory, at Eighth South and Fourth West Sts.

The city of Seattle, Wash., is planning the erection of a municipal garage and repair plant, in Dilling Park. R. H. Ober, superintendent of buildings, Seattle, has been commissioned to prepare plans.

The Palmer Calk Co., Spokane, Wash., recently incorporated with a capital stock of $750,000, will erect a plant, at Spokane, for the manufacture of chisel calks, steel centers, and mud calks. Phillip S. Palmer is the president.

The Bradley Cutlery Co., Medford, Ore., is contemplating the erection of a plant, at Medford, to cost $100,000. H. M. Platts is president.

N. P. Mader, Beaumont, Calif., will erect a modern commercial garage and repair shop, at Beaumont.

The Phillians Check Valve Co., Bakersfield, Calif., will erect a plant for the manufacture of a new check valve. E. D. Phillians is president.

J. C. Pursley, Longbeach, Calif., will erect a commercial garage and machine shop near the Hotel Virginia, Longbeach.

William Phillips, Mason Building, Los Angeles, Calif., is having plans prepared for a commercial garage and machine shop, to be erected at Seventh and San Pedro Sts., Los Angeles. J. B. Nicholson, Wright & Callender Building, Los Angeles, is the architect.

The Pacific Metals Product Co., Los Angeles, Calif., has been incorporated, with a capital stock of $500,000. The incorporators are Edward Double, H. W. Wells and W. L. Stewart. The company will erect a plant at Torrance, near Los Angeles, for the manufacture of steel tanks for gasoline.

Howard Berg, Ontario, Calif., will erect a large commercial garage and machine shop.

The Universal Tempered Gold & Silver Mfg. Co., San Diego, Calif., recently incorporated, with a capital of $1,000,000, has secured a site near Pacific Beach, Calif., and will build a large factory. J. H. Babcock and R. L. Palmer are interested.

The Olympia Salt Water Co., San Francisco,. Calif., will erect a large commercial garage and machine shop.

CANADA

The Pease Foundry Co., Brampton, Ont., has had plans prepared for a plant, consisting of a foundry with about 137,000 sq.ft. of floor space, and a two-story office building.

The Canadian Car Co. will erect a plant at Fort William, Ont., to cost about $1,000,000.

R. McDougal, manufacturer of pumps, Galt, Ont., is having plans prepared for the construction of a four-story addition to his factory, to cost about $10,000. Stewart & Witton, 2 Hughson St., are the architects.

The Canada Drawn Steel Co., Hamilton, Ont., will construct an addition to its plant.

The National Auto Body Co., Windsor, Ont., is building a plant at Windsor. Noted Apr. 25.

The shovel factory of George Wolfe & Sons, Montreal, Que., which was recently destroyed by fire, will be rebuilt.

The British Columbia Brass Co., New Westminster, B. C., will erect an addition to its plant.

NEW INCORPORATIONS

METAL

The following companies have been incorporated to manufacture:

The Worcester Wind Motor Co., Worcester, Mass.: piano motors. Capital, $30,000. Victor J. Johnson is president.

The Voorhees & Brown Electric Co., Amsterdam, N. Y.; electric machinery appliances. Capital, $5000. Incorporators: John H. Voorhees, Frederic W. Brown and Albert R. Larson.

The Duriron Castings Co., Manhattan, N. Y.; metal products. Capital, $50,000. Incorporators: P. D. Schenck, Dayton, Ohio; J. R. Pittman, Orange, N. J., and W. E. Hall, New York, N. Y.

The L. A. W. Carburetor Co., Manhattan, N. Y.; carburetors, and engine and automobile accessories. Capital, $100,000. Incorporators: N. Leinau, S. Heineman, New York, N. Y., and H. A. Watkins, Cos Cob, Conn.

The Osgood Oil Grooving Machine Co., Cranford, N. J.; lathes, engines, boilers and machinery. Capital, $25,000. Incorporators: I. Osgood, Alice L. Ray and E. W. Chadwick, all of 240 West North Ave., Cranford.

The C. M. Thompson Mfg. Co., Newark, N. J.; hose clamps and pressed steel articles. Capital, $55,000. Incorporators: Channing M. Thompson, Eugene F. Ball and R. Jones.

The Farmer's Garage, North Plainfield, N. J. Capital, $24,000. Incorporators: William H. Titus, N. H. Cleaves, both of Watchung, and George N. Winante, Plainfield.

The Lansden Co., Allentown, Penn.; motor engines and machines. Capital, $1,000,000. Incorporators: William D. Schantz, Allentown, Penn.; Willard L. Case, Plainfield, N. J., and W. J. Maloney, Wilmington, Del.

The Rush Bros. Co., Philadelphia, Penn.; light fixtures. Capital, $100,000. Incorporators: F. R. Hansell, Philadelphia, and George H. B. Martin and S. C. Seymour, Camden, N. J.

The Hercules Truck Co., Alexandria, Va.; automobile trucks. Capital, $100,000. Incorporators, S. W. Woodward, O. Ducker and B. E. Parker, all of Washington, D. C.

The National Machine Corporation, Suffolk, Va.; peanut machinery. Capital, $10,000. Incorporators, G. B. Walton, Norfolk, Va.; F. B. Bain, Wakefield, Va., and J. A. Lilliston, Norfolk.

The Birmingham Tool & Implement Co., Birmingham, Ala.; hay presses. Capital, $65,000. Incorporators, B. S. Weber, E. D. H. Spira and A. J. Groy.

The Alabama Harrow & Implement Co., Demopolis, Ala.; harrows. Capital, $25,000. Incorporators, A. A. Tibbs, Rane McMilloy and O. L. McKinley.

L. E. Steiner & Co., Louisville, Ky.; vehicles. Capital, $3000. Incorporators: Charles Eherenz, L. F. Steiner and M. M. Renn.

The Garwood Gas Lamp & Heater Co., Canton, Ohio; gas lamps, logs and heaters. Capital, $50,000. Incorporators: C. R. Welch, A. H. McCarty and Homer E. Black.

The Guide Motor Lamp Co., Cleveland, Ohio; automobile accessories. Capital, $100,000. Incorporators, H. J. Monson, W. H. Bunce and W. P. Persons.

The Bishop Gearing Wrench Mfg. Co., Findlay, Ohio; wrenches and tools, of iron and steel. Capital, $15,000. Incorporators, George R. Thompson, R. K. Davis and H. G. David.

The McCormick Mfg. Co., Lisbon, Ohio; vehicle couplers and articles of iron, steel and wood. Capital, $10,000. Incorporators, W. L. Ogden, B. & F. Hennasy and Joel L. Brown.

The Ideal Garage Co., Mansfield, Ohio. Capital, $6000. Incorporators, A. H. Summerville, Ida A. Summerville and B. C. Summerville.

The Star Mfg. Co., Carpentersville, Ill.; tools and machinery. Capital, $2000. Incorporators: Henry T. Rice, Edward C. Masters and Clarence E. Sawyer.

E. Silverman Sons, Chicago, Ill.; hardware specialties. Capital, $10,000. Incorporators: Emanuel Silverman, Milton Silverman and Edgar P. Silverman.

S. R. Fralich & Co., Chicago, Ill.; electrical and mechanical goods. Capital, $10,000. Incorporators: Syles R. Fralich, R. S. Torrence and William C. Duncan.

The Carborite Steel Bit Co., Springfield, Ill.; metal products. Capital, $5000. Incorporators: George A. Miller, M. L. Goodrich and Albert H. Roesler.

The Reliance Machine Co., Kansas City, Mo.; wagon scales. Capital, $30,000. Incorporators: S. H. Velie, T. A. Velie and P. L. Emerson.

The Marshall-Davis Co., Ltd., Dunsville, Ont.; electrical and gas equipment and supplies. Capital, $75,000. Incorporators, Thomas Marshall, Vernon J. Davis and W. D. Swayze.

For the convenience of readers, news items in this department are arranged geographically, by states. The various states will be grouped under subheads, as follows:

New England: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

Middle Atlantic: New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia.

Southern: Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Tennessee, Kentucky.

Middle West: Ohio, Indiana, Michigan, Illinois, Wisconsin.

West of the Mississippi: Iowa, Minnesota, Kansas, Nebraska, South Dakota, North Dakota, Wyoming, Colorado, Montana, Missouri, Arkansas, Texas, Oklahoma, New Mexico.

Western States: Idaho, Utah, Nevada, Arizona, Washington, Oregon, California.

General Manufacturing

NEW ENGLAND

The Sunn & Sweet Co., of Auburn, Maine, will build a new shoe factory and boiler house.

The Pepperell Mfg. Co., manufacturer of cotton goods, is building a large weave shed at Biddeford, Maine.

The electric-lighting plant of Boothbay Harbor, Maine, and the power plant and sealing department of the Maddocks Packing Co. were totally destroyed by fire.

The Armory Stay Co., manufacturer of shoe findings, Gardiner, Maine, will increase its capacity.

The Central Massachusetts Electric Co. is planning extensive improvements to its plant, at Blanchardville, Mass.

The mill of the Calvin Putnam Lumber Co., at Danvers, Mass., was destroyed by fire, May 3. Loss, $40,000.

The Appleton Co., manufacturer of cotton goods, Lowell, Mass., will soon erect a new mill. It will be five stories high, 96x210 ft., of brick. The estimated cost is $80,000.

The sifting plant of Dunn & McCarthy, at North Wilbraham, Mass., was destroyed by fire, May 6. Loss, $25,000.

The Manufacturers' Wool Stock Co., West Milford, Mass., is planning to build a wool-scouring mill, on Canal St., Millbury, Mass.

The woolen mill owned by David N. Taft, North Oxford, Mass., was destroyed by fire, May 1. Loss, $5000, covered by insurance.

The contract for the construction of a four-story addition to the mills of the Hamilton Woolen Co., Southbridge, Mass., has been awarded.

The Peoples Coal Co., Worcester, Mass., has completed plans for a large coal plant to be erected on Green St., to cost $100,000.

The Whitney Mfg. Co., 7 Vine St., Worcester, Mass., manufacturing stationers, will erect a new three-story plant at Barbers Crossing, 160x60 ft.

Power-plant equipment will be required for the new four-story factory building to be erected by George Dewars, at Union and Thomas Sts., Worcester, Mass., for a carriage and blacksmith shop.

Frank H. Nickerson, Worcester, Mass., is at the head of a new company recently formed to manufacture furniture and upholstery. The Westboro Mills, Westboro, Mass., have been purchased and will be equipped immediately.

An explosion badly damaged the powder mill of the Du Pont de Nemours Powder Co., at Hazardville, Conn.

The plant of the Interstate Rubber Co., Swartz & Corbett Block, South Norwalk, Conn., was damaged by fire, May 4. Loss, $20,000.

Plans are being prepared for a new factory, dyehouse and boiler house for H. Heminway & Sons Silk Co., Watertown, Conn. The factory will be 52x300 ft., three stories high, of brick. The dyehouse will be 52x82 ft., one story high, and the boiler and engine house will be 52x72 ft., one story high. Noted Mar. 28.

The Berbecker & Rowland Mfg. Co., Waterville, Conn., will erect a power house, 36x85 ft., one story high, of brick.

MIDDLE ATLANTIC

The Kings County Refrigerating Co., 30 Hall St., Brooklyn, N. Y., is planning the construction of a cold-storage plant in the vicinity of the old Fulton St. Ferry. The estimated cost is $300,000.

The factory of Silver & Co., manufacturers of novelties, 304-306 Hewes St., Brooklyn, N. Y., was damaged by fire, May 7. Loss, $25,000, covered by insurance.

The building at 98-108 Nostrand Ave., Brooklyn, N. Y., was damaged by fire, May 4. The building was occupied in part by the Star Show Case Co., the Williamsburgh Wagon Co., and the Aborn Opera Co., scenic studio. Total loss, $75,000, partly covered by insurance.

The Buffalo Weaving & Belting Co., 234 Chandler St., Buffalo, N. Y., will build an $8000 addition to its plant.

The leather dressing factory of Rogers & Smith, Gloversville, N. Y., was damaged by fire, May 1. Loss, about $40,000, covered by insurance.

The Montour Falls Steel Co., Montour Falls, N. Y., will construct an addition, 112 ft. long, to its plant.

The basement of 252 West Fifty-fifth St., New York, occupied by the Rubber Tire Co., was damaged by fire, May 4. Loss, $1200, covered by insurance.

Fire at 334 and 336 East Twenty-third St., New York, caused a loss of $100,000, May 7. The building was occupied in part by Jacob Leonhardt, marble worker, Jacob Bank & Co., cabinet makers, and Miller, Haase & Co., cabinet makers.

The Eastman Kodak Co., Rochester, N. Y., will erect an additional building to its plant. It will be a three-story structure, 80x100 ft.

The Hubbard, Eldredge & Miller Co., manufacturer of furniture, Rochester, N. Y., has filed plans for the construction of a brick addition to its factory. The structure will be 31x124 ft., of brick. The estimated cost is $12,000.

The Alexander Smith & Sons Carpet Co., Yonkers, N. Y., has let a contract for the erection of a four-story factory building, 190x75 ft., on Palisade Ave. The estimated cost is $140,000.

The cap manufacturing plant of Caplan Bros., at Mount Holly, N. J., was destroyed by fire, at a loss of $10,000.

The plant of the Hamilton Silk Co., 204 Straight St., Paterson, N. J., was damaged by fire, May 2. Loss, $6000.

The Mentor Knitting Mills, Mentor, Ohio, have decided to establish a plant in Erie, Penn., and will start operations immediately.

Fire, on May 1, entirely destroyed the lumber mill of G. H. Gibbs, Everett, Penn., at an estimated loss of $500,000.

The laundry of Herr & Clark, Harrisburg, Penn., was destroyed by fire, May 2. Loss, $15,000, partly covered by insurance.

Fire destroyed the planing mill and lumber yard of G. H. Gibbs, at Johnstown, Penn., May 1. Loss, $100,000; insurance, $6000.

The Powers, Weightman & Rosengarten Co., manufacturers of chemicals, Ninth and Parrish Sts., Philadelphia, Penn., will build an addition to its plant.

The Gregg Carriage Co., 1926 Arch St., Philadelphia, Penn., will construct an addition to its plant.

The Pennsylvania Sugar Refining Co., Pier 46, North Wharves, Philadelphia, Penn., will erect a large addition to its plant.

Swift & Co., Chicago, Ill., have awarded the contract for the construction of a cold-storage plant, at Philipsburg, Penn.

Hammon Bros., manufacturers of stogies, Pittsburg, Penn., have purchased a site adjoining their property, on Vine St., and will erect an addition to their plant.

The Rittler Box Co., Baltimore, Md., will erect a four-story addition to its plant, on Caroline St.

The plant of the United States Asphalt Refining Co., Wagners Point, East Brooklyn, Baltimore, Md., has been damaged by fire.

The Baltimore Mfg. Co., manufacturer of yeast, Baltimore, Md., is having plans prepared for the construction of two additional buildings to its plant. Both will be two-story structures, of brick and concrete. One to be at Monument and Buren Sts., and the other at Central Ave. and Bank St. J. E. Lafferty, 11 East Pleasant St., Baltimore, is the architect.

The Lion Bros. Co., Inc., embroidery manufacturer, Baltimore, Md., has had plans prepared and will receive bids for the construction of an addition to its factory.

Milburn, Heister & Co., Georgetown, Washington, D. C., are having plans prepared for the construction of a new power building.

SOUTHERN STATES

The Buffalo Lithia Springs Water Co. contemplates installing ice and refrigerating plant, at Buffalo Lithia Springs, Va.

The Virginia Paper Box Co., Norfolk, Va., will erect a two-story frame building, 35x60 ft.

Williams & Barrick will erect an extract works, at Petersburg, Va., near the Norfolk & Western R.R.

The Suffolk Overall Co. is erecting a factory near the Carr Hosiery Mills, Suffolk, Va. J. C. West is the manager.

The Monarch Carbon Co. will erect a plant at Cedar Grove, W. Va. J. D. Pribble is the president.

The Block Bros. Tobacco Co., Wheeling, W. Va., has awarded the contract to L. G. Hallock Son & Co., Wheeling, to erect a factory, 100x100 ft., four-story, reinforced concrete and fireproof construction.

The Alamance Power Co., Burlington, N. C., has been organized to build a hydro-electric plant to develop the water power. F. L. Williamson is the president.

The Durham Hosiery Mills, Durham, N. C., has awarded a contract to erect a 130-ft. addition to its Chapel Hill mill.

The American Hosiery Mills, Kernersville, N. C., has started to rebuild its plant recently destroyed by fire. Noted May 2.

The Fidelity Hosiery Mills Co., Newton, N. C., will erect an addition in the near future. Noted Apr. 18.

The Rocky Mount Sash & Blind Co., Rocky Mount, N. C., has plans prepared for a building, 143x160 ft., to cost $25,000.

The Armour Packing Co., Chicago, Ill., has awarded the contract for the construction of its plant, at Columbia, S. C. The estimated cost is $25,000. Noted Apr. 11.

The Camperdown Mills, Greenville, S. C., will build a brick addition, 30x40 ft., to their dye house.

Philip Alexander, Atlanta, Ga., contemplates building a sash, door and blind factory.

Swift & Co., Augusta, Ga., will erect a refrigerating plant, to cost $9000.

The American Bakeries Corporation, Birmingham, Ala., will erect two plants, one at Atlanta, and one at Macon, Ga.

The Central Georgia Power Co., Macon, Ga., will erect a large steam plant. W. J. Massee is the president.

A. B. Williford contemplates building ice and cold-storage plant at Arcadia, Fla.

An oil tank and the refinery of the Waters-Pierce Oil Co., at Dona Cecilia, Fla., were damaged by fire, Apr. 30.

The plant of the Ashland Oil Mill & Fertilizer Co., at Ashland, Ala., was destroyed by fire, Apr. 30. Loss, $50,000, partly covered by insurance.

William M. Crosby, Birmingham, Ala., has had plans prepared for the construction of a reinforced-concrete elevator, 40x80 ft., to cost about $30,000. H. D. Breeding, Birmingham, is the architect.

The E. & W. Dry Cleaning Co., Birmingham, Ala., will erect a building on 19th St., to cost $20,000.

The Boaz Oil Co., Boaz, Ala., will install a five-ton ice plant.

John H. Lay will erect a grist mill at Glencoe, Ala.

The Fowler Mfg. Co., Fort Payne, Ala., contemplates erecting a plant to manufacture grocery specials, at Gadsden, Ala.

The Tuscaloosa Ice & Light Co., Tuscaloosa, Ala., will build electric-light and power plant.

The Barrett Mfg. Co., 17 Battery Pl., New York, N. Y., will erect a large factory, on Broad St., Wylam, Ala., for the manufacture of roofing material. The estimated cost is $66,000.

S. N. Thomas, Jackson, Miss., will erect a knitting mill.

The Wausau-Southern Lumber Co., Laurel, Miss., is erecting a large sawmill.

The Richton Lumber Co., Richton, Miss., will erect a light and power plant for electricity, to cost $60,000.

The Vermillion Sugar Co., Abbeville, La., has started work on its new mill. Noted Apr. 18.

The Bowman-Hicks Lumber Co., Lake Charles, La., will build a sawmill, at Oakdale, La.

Charles R. Kennedy, New Orleans, La., received bids, May 13, to erect a refrigerating plant, 43x117 ft., at Dryades Market.

The Timpon Handle Factory, Shreveport, La., will begin work on its new factory within the next 30 days. H. R. Forey is the president.

The Southern Calcium Phosphate Co., Chattanooga, Tenn., which has been recently incorporated with a capital of $2,500,000, will build plants for the manufacture of fertilizer, at Atlanta, Macon, Birmingham, Selma and Mobile. John H. Hill, Chattanooga, is interested.

Bynum & Alexander, Gleason, Tenn., will erect a modern ginning plant.

The Broodside Mills, Knoxville, Tenn., is building an addition to its plant, to cost about $75,000.

The Fulton Construction Co., Knoxville, Tenn., will make another addition to its plant, on Second St., in West Knoxville.

The Brookside Cotton Mills, Knoxville, Tenn., will build an addition to its mill, to cost about $75,000. James Maynard is the president.

A. J. Baker and J. H. Mayes, Marion, Ky., are planning the construction of a flour mill.

T. V. Vigus, Memphis, Tenn., will install a refrigerating plant and meat-packing plant on Rosemary Farm.

The National Mosaic Flooring Co., Mobile, Ala., will erect a factory in Memphis, Tenn., at a cost of $100,000. William F. Tebbetts is the president.

Booth & Son, Pulaski, Tenn., will erect a cold-storage plant, to cost $20,000.

The Dawson Springs Water Co., Dawson Springs, Ky., will install a 10-ton ice plant.

The Farmers' Union Flour Mill, at Fulton, Ky., was destroyed by fire, Apr. 23. Loss, $20,000; insurance, $10,000. Charles Noonan is the owner.

The Louisville Paper Co., 235 East Main St., Louisville, Ky., was damaged Apr. 26, at a loss of $200,000.

The Kentucky Portland Cement Co., Pine Hill, Ky., recently incorporated in Baltimore, Md., is planning to build a cement mill near Pine Hill. E. M. Newton, Baltimore, is the president.

The plant of the MacMillan Mfg. Co., manufacturer of plow handles, 1236 Beech St., Parkland, Ky., was destroyed by fire, Apr. 27. Loss, $20,000; insurance, $14,000.

The Ford Lumber & Mfg. Co., Winchester, Ky., will build a mill construction box factory, 50x200 ft. C. F. Rood is the manager.

MIDDLE WEST

The Arkon Rubber Mould & Machine Co., Akron, Ohio, will erect a two-story brick and steel reinforced-concrete shop, to cost $10,000.

The Akron Paint & Varnish Co., Akron, Ohio, has awarded the contract for the construction of a steel and concrete factory.

The Portage Rubber Co., Akron, Ohio, is having plans prepared for the construction of a factory. Hogloch & Potter, Flatiron Building, are the architects.

The Sneed Box Co., Cleveland, Ohio, has secured a permit for an addition to its factory. The cost will be $18,000.

The Cleveland Electric Illuminating Co., Cleveland, Ohio, will erect, at 6513 Union Ave., a power substation, to cost $21,000.

A large dye works will be built by H. E. Thurston, at Cleveland, Ohio.

The cooperage department of the Standard Oil Co., at Broadway and East Thirty-fourth St., Cleveland, Ohio, was destroyed by fire, Apr. 28. Loss, $75,000.

The plant of the W. H. Stanage Co., printers and stationers, Pearl and Walnut Sts., Cincinnati, Ohio, was damaged by fire, May 4. Loss, $50,000, covered by insurance.

The J. E. Smith Shoe Co. is having plans prepared for an eight-story reinforced-concrete factory building, at Columbus, Ohio, to cost $150,000.

The Kerr Bros. Lumber Co., East Liverpool, Ohio, has started work on its new planing mill.

The Troxel Mfg. Co., manufacturer of tool boxes, Elyria, Ohio, is having plans prepared for the construction of a three-story factory, 125x250 ft. T. J. Bates, Whitney Power Building, is the architect.

The Defiance Tick Mitten Co., Toledo, Ohio, is having plans prepared for the construction of a two-story factory, which will adjoin its present structure.

The Ettel Furniture Co., Toledo, Ohio, manufacturer of furniture, are erecting a new factory.

The Indiana Silo Co., Anderson, Ind., will soon start work on its new plant, on Walnut St.

The plant of the Indiana Brick Co., near Anderson, Ind., was destroyed by fire, May 2. Loss, $100,000; insurance, $60,000. Thomas N. Stilwell, president of the company, states that the plant will be rebuilt.

The Ladoga Veneering Mill, owned by Harry Dougherty, of Ladoga, and R. C. Scott, of Crawfordsville, Ind., was destroyed by fire, May. 4. Loss., $40,000; insurance, $10,000.

The Federal Cement Tile Co., Hammond, Ind., will erect an additional factory building. I. H. Freund is the manager.

Adolph Leimgrube, London, Ind., is having plans prepared and will soon ask bids for the construction of a brick and concrete ice plant here.

The Adam H. Bartel Co., Richmond, Ind., is erecting an addition 115x120 ft., to its overall factory. A. H. Bartel is the president.

The Diamond Flint Glass Co., Vincennes, Ind., will rebuild its bottle plant, which was destroyed by fire.

The grist mill and elevator owned by George E. Wolf, Copemish, Mich., were destroyed by fire, Apr. 30. Loss, $12,000.

The Murphy Chair Co., Detroit, Mich., is erecting an addition to its factory.

The J. G. Kastler Co., 523 Chamber of Commerce Building, Detroit, Mich., are preparing plans for the construction of a two-story and basement bakery, 24x80, for J. Nienice, 1514 Campbell Ave. The estimated cost is $15,000.

The Huebner Mfg. Co., Detroit, Mich., manufacturer of sashes and doors, is building an addition to its factory.

The Detroit Soda Products Co., Detroit, Mich., is erecting an addition to its plant.

The Goodyear Tire & Rubber Co., Akron, Ohio, will build a branch plant at Detroit, Mich.

The E. W. Alexander & Co., Detroit, Mich., manufacturers of umbrellas, parasols and canes, is erecting a new factory, on John St.

The plant of the W. H. Chase Furniture Co., on Brown St., Grand Rapids, Mich., was damaged by fire, May 4. Loss, $2000.

The O. F. Schmidt Chemical Co., Jackson, Mich., will erect a three-story factory, 70x95 ft. Claire Allen & Son are the architects.

J. A. Gibert, 104 West Pearl St., Jackson, Mich., has had plans prepared and is about to award the contract for the construction of a four-story factory, 66x132 ft., to manufacture confectionery. The estimated cost is $25,000. L. H. Field, Jr., Field Bldg., Jackson, is the architect.

The contract for the construction of a four-story candy factory for J. A. Gilbert, Jackson, Mich., has been awarded, and will cost $25,000.

The Lull Carriage Co., Kalamazoo, Mich., is having plans prepared for the construction of a four-story factory, 80x240 ft. R. H. Le Roy is the architect. The estimated cost is $45,000.

The contract for the construction of a one- and two-story factory, 110x75, for the Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich., has been awarded. The estimated cost is $45,000.

The American Provision Co., Chicago, Ill., will build a two-story brick engine room, at 7210 Perry Ave. Frank W. Perkins is the architect.

Jones Bros. & Co., Louisville, Ky., will erect a factory, at Springfield, Ill., for the manufacture of cider and vinegar. Samuel Jones is president.

H. H. Solie, Augusta, Wis., is having a new addition built on his cheese factory.

The mill of the North Star Lumber Co., at Bloomer, Wis., was destroyed by fire, May 4. Loss, $6500, covered by insurance.

The E. P. Doty Co., Janesville, Wis., advises us that it will build a three-story frame building, 50x85 ft., to replace the one recently destroyed by fire. E. P. Doty is the president. Noted May 2.

The American Seating Co., maker of church and school furniture, Manitowoc, Wis., will enlarge its plant. T. M. Boyd is the president.

The Marinette Carriage Works, Marinette, Wis., will erect a two-story building. Andrew Hain is the proprietor.

The Lorenz Bros. Macaroni Co., Milwaukee, Wis., contemplates the erection of a factory building.

The Phoenix International Light Co., 525 Market St., Milwaukee, Wis., will erect a six-story reinforced-concrete manufacturing building.

Charles Fischer will erect a new cement-block factory, 40x100 ft., at Thirty-ninth Ave. and South Pierce St., Milwaukee, Wis.

The Federal Rubber Mfg. Co., Milwaukee, Wis., is having plans prepared for the construction of a six-story addition, 400x100 ft., to its plant, at Cudahy.

WEST OF THE MISSISSIPPI

A special election will be called to vote bonds of $25,000 for the construction of a municipal lighting and pumping plant for Charles City, Iowa.

The National Wood Works Co., Sioux City, Iowa, whose plant was recently destroyed by fire, will rebuild at Sixth and Water Sts.

The Kenfield-Lamereau Co., Bemidji, Minn., manufacturer of crates and boxes, will build a factory, at Bemidji.

Fire in the dry kiln of the Gee Elevator, at 112 Polk St., Minneapolis, Minn., caused a loss of $5000, May 3. The elevator is owned by George E. Gee.

The Northwestern Compo Board Factory, at Forty-fourth and Lyndale Aves., Minneapolis, Minn., was damaged by fire, May 2. Loss, $2000.

The Farmers' Coöperative Elevator Co., Newfolden, Minn., will erect an elevator and a feed mill and grain cleaner will be installed.

The city of Red Lake Falls, Minn., will vote bonds for $25,000, about May 14, for the construction of water-works.

Plans have been completed for a new water-works system, at Chapman, Kan., estimated to cost between $20,000 and $25,000. Burns & McDonnell, Scarritt Building, Kansas City, Mo., are the engineers.

Bids will be asked about June 15 for the installation of a water-works system, at Moran, Kan. The estimated cost is $30,000. The Midland Engineering & Construction Co., Fort Scott, Kan., is the engineer.

The Mentholatum Co., Wichita, Kan., is building an addition, 25x76 ft., to its plant, at Cleveland and Douglas Aves. The estimated cost is $6000.

The Alamo Engine & Supply Co., Omaha, Neb., are preparing plans for a water-works system, at Bassett, Neb.

Bids will soon be asked for the construction of a new water-works, at Gretna, Neb. The estimated cost is $15,000. Bruce & Standevin, Bee Building, Omaha, Neb., are the engineers.

The Positive Print Machine & Paper Co., Omaha, Neb., will establish a factory at Council Bluffs, Iowa, to cost about $25,000.

Bids will be received by N. T. Woods, city auditor, Mobridge, S. D., until 8 p.m., May 18, for the construction of five blocks of water mains and four hydrants.

The city of Culbertson, Mont., will expend about $1400 on improvements to the water system.

The Great Falls Power Co., Great Falls, Mont., will erect a flour mill.

The Charles F. Bassen Woodworking Co., Hannibal, Mo., recently incorporated with a capital of $40,000, will establish a wood-working plant.

The Meriden Creamery Co., 546 Walnut St., Kansas City, Mo., will build a two-story creamery and ice plant, 50x145 ft., to cost about $60,000.

The Henry Quellmalz Lumber Mfg. Co., St. Louis, Mo., whose plant was recently burned, will rebuild. Noted May 2.

Bids will be received until 6 p.m., May 18, for the improvements to the water system of the city of Webster Groves, Mo. The Fuller-Coult Co., Chemical Bldg., St. Louis, Mo., are the engineers.

Short & Jones will build a hardwood and stave mill at Glenwood, Ark.

The Delta Light, Power & Mfg. Co., Little Village, Ark., will build an electric-light plant. E. J. Leuz, Greenville, Ark., is superintendent.

The Pine Bluff Compress & Warehouse Co., Pine Bluff, Ark., has awarded the contract for the erection of a cotton compress, warehouse and sheds. The estimated cost is $40,000.

Barber & Barton, Buda, Tex., are installing a cotton gin at Buda, at a cost of $50,000.

The El Paso Milling Co., El Paso, Tex., which is erecting a box factory and planing mill, contemplates the installation of a large paper mill, which will utilize bear grass for the manufacture of paper.

M. E. Sullenberger and associates, Gilmer, Tex., are erecting a cotton-seed oil mill at Gilmer, at a cost of about $25,000.

Charles E. McSweeney has acquired a site in Hillsboro, Tex., covering about eight acres, on which he will build a pork-packing plant, with an annual capacity of about 50,000 hogs.

The Guadalupe Water Power Co., Seguin, Tex., recently organized, with a capital stock of $600,000, will construct a series of dams and hydro-electric-power plants upon the Guadalupe river, between Seguin and New Braunfels, Tex.

George Walker, San Gabriel, Tex., is planing to install an electric-light plant and ice factory at Copperas Cove, Tex.

The Ohio Valley Mfg. Co., Owensboro, Ky., will build a table factory at Waco, Tex.

The Planters' Cotton Gin Co., Haskell, Okla., will construct a cotton gin at Haskell.

M. B. Gilbert, Meridian, Okla., is considering the construction of a cotton compress.

C. C. Rogers, Deming, N. M., has a site one mile east of Deming, and will install a pumping plant.

WESTERN STATES

The Idaho Consolidated Power Co., American Falls, Idaho, will spend $1,000,000 for the erection and equipment of a new power-house, at American Falls.

Hubert H. Heath, Douglas, Ariz., is planning the erection of a broom factory, at Douglas.

The Apex Fish Co., Anacortes, Wash., is planning to enlarge and improve its plant. Lee H. Wakefield is manager.

The contract has been awarded for installing the water system, at Brewster, Wash.

Senator E. Milton Stephens and associates, Bellingham, Wash., are contemplating the erection of a lumbering plant, at Duvall, Wash., to cost $100,000.

The Wallace Lumber & Mfg. Co., Everett, Wash., will install new machinery and make other improvements to its plant.

The city authorities of Tacoma, Wash., are considering a proposition to purchase an asphalt paving plant.

J. F. Bane, Bandon, Ore., has purchased the Jamieson sawmill plant on the Sixes River, near Bandon. It will be reconstructed and enlarged.

H. N. Woods, Klamath Falls, Ore., will erect a factory for the manufacture of wooden pails and tubs.

Press reports state that C. E. Smith, of the C. A. Smith Lumber & Mfg. Co., is financially associated with Hjelte Nerdrum and Rolf Nerdrum in the construction of a pulp and paper mill, at Marshfield, Ore. It will be built at the Smith mill. The estimated cost is $750,000.

W. B. Fleming, Nampa, Ida., has acquired a site at Nyssa, Ore., and will erect a plant for the manufacture of cement block.

L. F. Norton, Herman Neipp, David Darling and C. B. Reynolds have organized a company, at Blythe, Calif., and will erect an ice plant.

The Casa Grande Ice & Cold Storage Co., Casa Grande, Calif., is planning the construction of an ice plant.

The California & Hawaii Sugar Co., Crockett, Calif., will build a refinery, at Crockett, on property adjoining the present plant.

S. W. Lutweiler, Whittier, Calif., will install a complete new water plant on his property, at East Whittier.

The Golden State Mining & Marble Co., El Centro, Calif., will erect a plant at El Centro for dressing and shipping marble.

A. B. Evans, Imperial, Calif., has purchased a site at Imperial, and will erect a large creamery plant. Ice will also be manufactured, and a cold-storage department will be maintained.

The Imperial Cannery Co., Imperial, Calif., recently organized, will erect a large vegetable-canning plant.

The Lindsay Packing House Assn., Lindsay, Calif., will erect the largest orange-packing plant in the world. It will also build an addition to its present plant.

The Long Beach Consolidated Gas Co., Long Beach, Calif., will erect a new gas plant on West Anaheim St., Long Beach. The estimated cost is $250,000.

Herman Dyer, city clerk, Pasadena, Calif., will receive bids until May 21, for furnishing plans, specifications, labor, material and appurtenances necessary for the erection and completion of an incinerator plant for the disposal of garbage.

The Midas Fruit Co., Rialto, Calif., will install four electric pumping plants on its properties, in Bloomington.

The San Diego Sand Paper Co., San Diego, Calif., is planning the erection of a new factory, on Twelfth St., National City, Cailf. Ralph R. Cone is president.

A. T. Ward and J. M. Packard, Santa Paula, Calif., have purchased the Santa Paula Steam Laundry. The capacity of the plant will be increased and new machinery installed.

CANADA

The paper mill of Crabtree & Son, at Lake Oiseau, near Joliette, Que., was destroyed by fire, May 7. Loss, $75,000.

The Willow Cheese Factory, at South Augusta, Que., was destroyed by fire, May 4. Loss, $7000; insurance, $4000. The factory was owned by James Bissell & Son, Brockville, Que.

Bids are being received for the construction of an addition to the plant of Snyder Bros. Upholstering Co., Berlin, Ont.

The Dominion Safety Explosive Co. is building a plant at Cobalt, Ont.

The Eganville Pulp, Milling & Mfg. Co. will equip a new $100,000 plant, at Eganville, Ont.

The Canadian Cereal Co., Fergus, Ont., will rebuild its factory, which was recently destroyed by fire. It will be a two-story brick building.

The Edwardsburg Starch Co., L'Original, Ont., will build a branch factory, at Fort William, Ont. The estimated cost is $350,000.

The Hamilton Lewitt Knitting Co., Glencoe, Ont., will remove to Amherstburg, Ont., and will double the capacity of its plant.

The Guelph Carpet Co., Guelph, Ont., is contemplating the erection of a three-story addition, 60x60 ft., to its factory.

The Kingston Brick & Tile Co. will equip a new plant, at Kingston, Ont., to cost $75,000.

The Fenlin Leather Co., Montreal, Que., will build a large addition to its factory.

The Interlake Paper Co. is building a large new factory, at Merritton, Ont. D. J. Albertson, Kalamazoo, Mich., is the architect.

The Strathroy Canning Co., Strathroy, Ont., is erecting a three-story addition, 85x60 ft., to its plant.

The factory of the Jackson Hat Co., 1402 Queen St., Toronto, Ont., was damaged by fire, May 1. Loss, $500.

The picker room of the Imperial Cotton Co., at Toronto, Ont., was damaged by fire, May 3. Loss, $2500.

The Dominion Milling Co., Melville, Sask., will build a flour and oatmeal mill, with a capacity of 300 bbls.; also two elevators.

Melfort, Sask., will equip a new electric-power house with machinery.

The city of Nanaimo, B. C., will soon vote bonds for $50,000 for improvements to its water system.

New Incorporations

GENERAL

The following companies have been incorporated to manufacture:

The Washington Bowling Co., Buffalo, N. Y.; bowling alleys. Capital, $10,000. Incorporators, William Kelley, West Tupper St., George H. Smith, 76 West Huron St., and M. Kelley, 42 West Tupper St., Buffalo.

Charles Simon's Sons, Manhattan, N. Y.; hosiery and underwear. Capital, $75,000. Incorporators, H. Simon, M. Simon and J. M. Simon.

The B. F. Goodrich Co., Manhattan, N. Y.; rubber goods. Capital, $45,000,000. Incorporators, B. G. Work, C. B. Raymond, Akron, Ohio, and D. M. Goodrich, New York, N. Y.

The Irving Mills, Manhattan, N. Y.; cotton goods. Capital, $25,000. Incorporators, I. Weiser, J. J. Schwebel and M. Winder.

The Holmes-Atwood Co., Manhattan, N. Y.; household and office furniture. Capital, $10,000. Incorporators, Dwight P. Diworth, 230 Riverside Drive, New York, N. Y.; J. B. Miller, Bloomfield Ave., Caldwell, N. J., and Edward E. Fay, 140 Macon St., Brooklyn, N. Y.

The Pollack Tyre & Rubber Co., Manhattan, N. Y.; automobile tires and rubber goods. Capital, $700,000. Incorporators, J. E. Crowley, E. Halpert and J. A. Damman, New York, N. Y.

The Ryon Glass Co., Manhattan, N. Y.; glassware. Capital, $1,000,000. Incorporators, Thomas Young, Max Karger and Lindsay Duncan Holmes, New York, N. Y.

The Clavel Mfg. Co., Manhattan, N. Y.; monuments and burial vaults. Capital, $15,000. Incorporators, Lyman Bartlett, 206 Broadway; Joseph St. Clair, 226 West 129th St., and William T. Criswell, 150 Nassau St., New York, N. Y.

The Alpha Brush Co., Troy, N. Y.; brushes and toilet articles. Capital, $20,000. Incorporators, Hyman S. Mark and James W. Bradshaw, Troy, and William Lester, Albany.

The Silica Brick & Tile Co., Watertown, N. Y. Capital, $75,000. Incorporators, W. H. Gardner, J. F. La Rue, Philadelphia, Penn., and O. Watson, Watertown.

The Oetel & Pirnay Mfg. Co., Atlantic Highlands, N. J.; silk and other textile fabrics. Capital, $50,000. Incorporators, G. R. Oetel, Atlantic Highlands; O. Ludwig, New York, N. Y., and E. Pirnay, Philadelphia, Penn.

The Penn. Cork & Seal Co., Camden, N. J.; bottles, jars, corks and stoppers. Capital, $100,000. Incorporators, Frank A. Boyer, H. B. Cassel and Charles U. Martin, all of 419 Market St., Camden, N. J.

The Alfred W. Smith Co., Camden, N. J.; window frames. Capital, $20,000. Incorporators, A. W. Smith, W. H. Jones and H. C. Fay, Camden.

The Cambridge Woolen Mills, Camden, N. J.; cotton, woolen and worsted goods. Capital, $25,000. Incorporators, R. T. Foulk, J. Y. Young, Philadelphia, Penn., and H. A. Drake, Camden, N. J.

The Bailey & Bridge Co., Newark, N. J.; laces, draperies and textile fabrics. Capital, $25,000. Incorporators, G. Bailey, G. F. Bailey, New Rochelle, N. Y., and C. H. Bridge, Newark, N. J.

The Old Dominion Glass Corporation, Alexandria, Va.; glass. Capital, $100,000. Incorporators, G. H. Schwarzman and G. D. Hopkins.

The Rockingham Bedding Co., Rockingham, N. C.; cotton bedding and mattresses. Capital, $25,000. Incorporators, Claude Gore, J. T. West and P. W. West.

The National Clay Co., Hatton, Ohio; drain tile, brick and hollow ware. Capital, $30,000. Incorporators, C. H. Sankey, Jesse Stephens and George E. Reed.

The Fulton Glass Co., Chicago, Ill.; glass. Capital, $35,000. Incorporators, Park Phipps, John L. Bolen and Alma C. Larson.

The Manufacturers' Bureau, Chicago, Ill.; picture frames and moldings. Capital, $2500. Incorporators, William E. Kaiser, Ida Slora and Percival Steele.

The Swann Furniture Co., Tyler, Tex.; furniture. Capital, $100,000. Incorporators, T. E. Swann, T. B. Butler and E. E. Carleton.

The British Canadian Lumber Corporation, Ltd., will build a reinforced-concrete power house with steel roof for the mill on LDulu Island. Estimated cost, $8000.

Victoria, B. C., will readvertise for bids to construct a power plant, at Sooke Lake.

Trade Catalogs

Crocker-Wheeler Co., Ampere, N. J. Pamphlet. Electric fans. Illustrated, 16 pages, 7½x10 in.

Celfor Tool Co., Chicago, Ill. Catalog No. 11. Tools and devices. Illustrated, 33 pages, 6x9 in.

Fellows Gear Shaper Co., Springfield, Vt. Pamphlet. Gear shaper. Illustrated, 16 pages, 6x9 in.

Damascus Bronze Co., Pittsburg, Penn. Catalog. Bronze bearings. Illustrated, 23 pages, 6x8¾ in.

Standard Machinery Co., Providence, R. I. Catalog. Drop presses. Illustrated, 45 pages, 6x9 in.

G. W. Paxson Co., Philadelphia, Penn. Bulletin No. 26. Foundry cupolas. Illustrated, 36 pages, 6x9 in.

Bemis & Call Hardware & Tool Co., Springfield, Mass. Catalog. Wrenches. Illustrated, 16 pages, 6x9 in.

Electro-Magnetic Tool Co., Chicago, Ill. Bulletin No. 2. Electric hammers. Illustrated, 16 pages, 6x9 in.

Owen Machine Tool Co., Springfield, Ohio. Booklet. Milling machines. Illustrated, 92 pages, 4¾x6 in.

The Watson-Stillman Co., New York City. Catalog No. 83. Hydraulic benders. Illustrated, 64 pages, 6x9 in.

Crocker-Wheeler Co., Ampere, N. J. Bulletin No. 141. Alternating-current motors. Illustrated, 16 pages, 7¼x9¾ in.

Gem Mfg. Co., Pittsburg, Penn. Catalog. Oilers, torches, foundry chaplets, flexible shafting. Illustrated, 46 pages, 6x9 in.

Betts Machine Co., Wilmington, Del. Booklet No. 1R. Modern machine tools in use by prominent railroads. Illustrated, 16 pages, 4x6¼ in.

Cincinnati Bickford Tool Co., Oakley, Cincinnati, Ohio. Catalog. Heavy pattern upright drilling and tapping machines. Illustrated, 58 pages, 6x9 in.

Sowers Mfg. Co., Buffalo, N. Y. Catalog V. Sections 1 and 2. Special machinery, grey-iron castings. Illustrated. Section 1, 43 pages. Section 2, 50 pages, 6x9 in.

Forthcoming Meetings

National Machine Tool Builders' Association. Semi-annual convention, May 16-17, Atlantic City, Hotel Chalfonte. James H. Herron, secretary, Engineers Building, Cleveland, Ohio.

National Association of Manufacturers. Annual convention, May 20-22, Waldorf-Astoria, New York City. George S. Boudinot, secretary, 30 Church St., New York City.

American Society of Mechanical Engineers. Spring meeting, May 28-June 1, Hotel Hollenden, Cleveland, Ohio. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June 12-14. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June 17-19. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

Society for the Promotion of Engineering Education. Annual meeting, June 26-28, Boston, Mass. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

Society of Automobile Engineers, summer meeting, June 27-29, Hotel Ponchartrain, Detroit, Mich. C. F. Clarkson, secretary, 1451 Broadway, New York City.

American Railway Tool Foreman's Association. Annual convention, July 9, 1912, Chicago, Ill. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Foundrymen's Association. Annual convention, Buffalo, N. Y., Hotel Statler, Sept. 24, 25, 26. Richard Moldenke, secretary, Watchung, N. J.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. Walter M. Smyth, secretary, 116 Nassau St., New York City.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

SUPERINTENDENT wanted for factory employing about two hundred and fifty men in the manufacture of steel stampings; technical education desirable, but not essential, but must be able to obtain maximum production at a minimum cost. Address, stating education, experience and salary desired, "Connecticut," care Am. Machinist.

DESIGNER—By large Eastern manufacturer of machine tools, machinery and mechanical specialties, a chief designer of proven ability; a record of achievement is essential, and all applicants to receive consideration must be thoroughly explicit in describing their records; past and present employers, age and salary expected should be stated; all applications will be treated with strict confidence and no inquiries regarding any will be made without first consulting applicant. Box 245, Am. Machinist.

Illinois

DRAFTSMEN AND TRACERS — We are constantly in need of the services of first-class draftsmen and tracers; some men are required on tool work and it is possible to place some on detailed and assembled drawings of agricultural implements. Applications requested addressed David Bradley Manufacturing Works, Bradley, Ill.

Indiana

FOREMEN — A growing automobile factory is in need of foremen; state fully your experience, give age and salary expected. Box 293, Am. Machinist.

Iowa

MECHANIC, first class, capable of handling gear cutting in a large factory in Iowa; must be familiar with all kinds of gears, bevel, spiral and spur. Box 253, Am. Machinist.

FOREMAN — Experienced automatic machine foreman, capable of tooling Brown & Sharpe, National Acme, Cleveland and Potter & Johnston machines and producing accurate work at the least cost; permanent position; state experience and wages expected. Address "Automatic," Am. Machinist.

Maryland

DRAFTSMAN, experienced in high-speed stationary engines. Box 227, Am. Machinist.

DRAFTSMEN on steel hulls for barges; detail work; permanent positions to competent men. Box 250, Am. Machinist.

DRAFTSMEN, eperienced on general heavy machine work, steam engines and steel hulls; state age and experience. Address George Smith, 709 Second St., Canton, Baltimore, Md.

Massachusetts

DRAFTSMAN—One who has had experience in hydraulic elevator work preferred. Box 307, Am. Machinist.

GEAR-CUTTER OPERATOR wanted on large and medium gears, on Gould & Eberhardt machines; steady work. Deane Steam Pump Co., Holyoke, Mass.

A GERMAN-AMERICAN, who can talk both English and German fluently, and who has a practical knowledge of small tools, to represent a large manufacturing concern throughout Germany. Box 284, Am. Machinist.

DESIGNERS AND DRAFTSMEN, accustomed to rotary and flat-bed printing presses; excellent position for those who can qualify; apply giving former positions and references, salary expected, also age and if married. Box 237, Am. Machinist.

DRAFTSMEN, by a large pump manufacturer, with several years' experience, capable of detailing from layouts and doing simple designing under direction of leading men; state fully experience, education, age, references, pay expected, etc. Address "Draftsman," Box 285, Am. Machinist.

Michigan

FOREMAN in machine department of firm making hoisting machinery; progressive, hustling, production man; good chance for advancement to more important position for right man; state experience and wages. Box 283, Am. Machinist.

New Jersey

ASSEMBLER—Company manufacturing line of work, classed as sewing machine work, wants a good man on assembling; state experience and wages expected. Address Acme Staple Co., Limited, 112 North Ninth St., Camden, N. J.

DRAFTSMAN, first-class, wanted for general engineering work, familiar with machine tools and shop practice. Give

full particulars of experience, also age and salary expected. The Alexander Traud Co., Newark, N. J.

New York

OPERATORS—Automatic screw machine, on Brown & Sharpe and Acme machines; state experience and wages expected; references required. Address Camera Works, Eastman Kodax Co., Rochester, N. Y.

TOOL MAKERS, few first class, on small accurate work; good wages and steady employment; also two screw machine hands; only competent men need apply. Bundy Mfg. Co., Endicott, N. Y.

MECHANICAL DRAFTSMAN, thoroughly competent, who has a complete knowledge of flour blending, sifting and weighing machinery; give experience, references, salary expected, etc., in first letter. Box 189, Am. Machinist.

FOREMAN for department in assembling machine tools; none wanted but a hustler that can produce results; unusually good opportunity for the right man; state age, experience and salary expected. Box 295, Am. Machinist.

FOREMAN, thoroughly familiar with building special and automatic machinery; must be first-class mechanic, with experience in handling men, and producing results; state experience, age and salary expected. Box 296, Am. Machinist.

ASSOCIATE EDITOR for a technical journal in the machine-building field; a technical education or its equivalent; thorough experience in machine design and machine shop practice, and demonstrated ability to write are essentials. Box 300, Am. Machinist.

Ohio

SALESMAN, machine tool, first class, wanted for New England territory; permanent position for the right man. Box 306, Am. Machinist.

DIE AND JIG MAKERS, first-class, on high-grade telephone work; state experience and wages. American Automatic Telephone Co., Urbana, Ohio.

MACHINIST, thorough, young man, conversant with machine tool and jig making, to work in and take charge of a small tool room. Box 303, Am. Mach.

AN EXPERIENCED MAN who understands laying out, manipulating and erecting light structural steel work and is capable of efficiently directing men, to take charge of a steel passenger car shop. Box 304, Am. Machinist.

EFFICIENT EXECUTIVE in drafting room, with experience in machine tool design, preferably lathes and their attachments; applicant must be capable of handling men, and get the work through accurately and without delay; do not apply unless you have had several years' experience in work of this character; please give complete references and salary expected. Box 305, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

Pennsylvania

ELECTRICAL INSTRUMENT MAKERS, first class. Apply by letter, Employment, Box 911, Pittsburg, Penn.

OPERATOR, Jones & Lamson, experienced on small tool work. A. H. Fox Gun Co., 4600 N. 18th St., Philadelphia, Penn.

OPERATORS — First-class automatic screw-machine operators, familiar with Cleveland machines; steady work. Apply to Flannery Bolt Co., Bridgeville, Penn.

DRAFTSMEN, several; applications solicited from men with either ordnance, mechanical-electrical, or mechanical-structural experience; state fully age, experience, education and salary expected. Box 319, Am. Machinist.

MECHANICAL DRAFTSMEN, experienced in the design of motors, generators and detail apparatus, such as controllers, switchboards, circuit breakers, etc.; state experience and salary expected; only first-class men need apply. Address "Chief Clerk," Engineering Department, Westinghouse Electric & Mfg. Co., East Pittsburg, Penn.

ESTIMATOR, capable of estimating the time required to finish castings or forgings in a shop equipped with large and heavy tools; preference will be given to applicants with correspondence or technical school training in addition to machine shop experience; applicants for the position will state in full experience, training, education, salary expected, etc. Treadwell Engineering Co., Easton, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wisconsin

FOREMAN for assembling department of large contract factory making all kinds of stamped metal articles; exceptional opening for experienced man of executive ability. Box 324, Am. Mach.

MANUFACTURING concern desires a man with some experience to take charge of chemical and physical laboratory, steel work chiefly, including analysis and heat treatments. Address, stating experience and salary, Box M. L., Am. Mach.

FOREMAN required for transmission and axle assembly departments in automobile part manufacture; applicant must have successfully handled such departments on progressive methods; state full particulars and salary expected. Box 314, Am. Machinist.

BECAUSE of the rapid growth in our business we are constantly on the lookout for keen, able and practical men in the various departments of our works; for men above the average such positions offer splendid opportunities; in addition to our assembling rooms, we operate our own machine shops, drop forge plant, foundries and body works and invite correspondence from men whose experience convinces them that their ability is above the ordinary; one-third of our present employees have been with the management of this company from eight to twenty-six years. Address Factory Manager, The Thomas B. Jeffery Co., Kenosha, Wisconsin.

Positions Wanted

Connecticut

DRAFTSMAN with various experience, some experience as detailer on machine tools, wishes change. Box 317, Am. Mach.

ASSISTANT SUPERINTENDENT or foreman, technical education, married, age 40, desires responsible position. Box 320, Am. Machinist.

Illinois

GENERAL FOREMAN, 20 years' uptodate experience, thorough mechanic and producer; Middle West; employed; A1 References. Box 291, Am. Machinist.

FOREMAN—Responsible position by married man, 35 years of age; experienced tool-room foreman, master mechanic and superintendent; references. "T. W. R.," Am. Machinist.

DESIGNER, experienced, with thorough shop experience in motor trucks, auto fire engines, rotary and piston type, desires position with live concern. Address Box 312, Am. Machinist.

Indiana

STOREKEEPER or assistant to purchasing agent; twelve years' experience with railroad and large manufacturers; can qualify for any position in above departments; best references, how employed; salary $1200 to start. Address "B. G.," Box 302, Am. Machinist.

Massachusetts

MECHANICAL ENGINEER, technical graduate, one year's experience superintending and systematizing manufacture of small tools; familiar with modern production and cost methods; change desired; references furnished. Box 315,

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 323, Am. Machinist.

DRAFTSMAN—Young man with shop experience desires position. Box 322, Am. Machinist.

DESIGNER, experienced on heavy and automatic machinery, wishes a responsible position. Box 316, Am. Machinist.

METAL PATTERN MAKER, first-class, all-round, desires position in or about New York City. Box 313, Am. Mach.

MECHANICAL ENGINEER, graduate, German, 26, seven years' practical experience, four years in United States, wishes position. Box 309, Am. Machinist.

DRAFTSMAN, with long experience on mill work and machinery wishes position, New York City or vicinity. Box 298, Am. Machinist.

DRAFTSMAN, 30, broad experience in special machinery, tools, etc., for interchangeable parts, desires position. Box 299, Am. Machinist.

DRAFTSMAN, experienced, designing light and special machinery; good, original ideas; fast and accurate; good references. Box 310, Am. Machinist.

FOREMAN of sheet metal tool and die room, drawing dies a specialty; several years' experience in die designing; wishes a change of location; can furnish A1 references. Box 321, Am. Machinist.

TOOL MAKER, 19 years' experience; strictly first-class and up to date on all kinds of tools, experimental work and automatic machinery; have also had charge and hold position as inspector; would like to make a change. Box 318, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

MECHANICAL ENGINEER, designer, technical graduate, practical shop and office experience in general and marine work; would consider sales department. Box 294, Am. Machinist.

SUPERINTENDENT wishes to make permanent connection with Eastern concern; American, 42 years old; 20 years' experience in general manufacturing and making light automatic machinery; not one of the know-it-all kind, but do know how to make good; machinist and tool maker by trade; would be pleased to call on party if so desired, or to be seen at present location. Box 292, Am. Mach.

Pennsylvania

MASTER MECHANIC—I wish to correspond with a firm desiring the service of an uptodate master mechanic. Box 301, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

For Sale—Correspondence course in mechanical drawing. Box 308, Am. Mach.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Broken machinery welded and guaranteed. Waterbury Welding Co., East Waterbury, Conn.

Work for 2x24 Jones & Lamson lathes and work for automatic gear cutters wanted. Box 267, Am. Machinist.

For Sale—One 8"x24" Allis-Chalmers Corliss engine; one four-spindle Turner cock grinder; first-class condition. For prices apply to J. E. Lonergan Co., 211 Race St., Philadelphia, Penn.

I want well equipped factory to take over manufacture of small patented article for automobile trade; perfected and on the market; will bear rigid investigation. Box 279, Am. Machinist.

Open-end planer, 6 ft. wide, 12-ft. stroke, also good milling machine with gear-cutting attachments wanted; must be modern, in good condition, capable of doing accurate work and offered at real bargain; give detailed and illustrated description and state lowest price in first letter. Wm. L. Packard, Geneva, N. Y.

Proposals for Ordnance Supplies—Watervliet Arsenal, Watervliet, N. Y., April 25, 1912—Sealed proposals, in triplicate, will be received until 1 p.m., May 25, 1912, for furnishing steel, hardware, forage, fuel, oils, etc., during year ending June 30, 1913. Information furnished on application. Lt. Col. W. W. Gibson.

Talks With Our Readers

By The Sales Manager

And here he is again:

WHEELING, W. VA.,
Feb. 12, 1912.

AMERICAN MACHINIST:

I enclose business card of a well dressed and carefully accented and scented foreign gentleman, with cane and suede glove attachments, who sells 12″ to 16″ files only, by the pound; these files being made of a special steel, with improved cutting qualities and not liable to breakage.

The files are hand cut by Swiss and French workmen in "Paree"—"You have been there, is it not"? A very thin six-inch file was exhibited as a sample of quality and flexibility, although they made none like that, only heavy files 12″ and over. A great discrepancy between the firm name and monogram on the sample was explained as being some manager's private mark and of no consequence whatever.

In addition to the attractive prices quoted, which had none of the objectionable features of the standard list and variable discounts and considering the fine quality of the steel, these files only would be recut for 3c. each in "N-Yok"—"You have been there, yes?" They were just as good as new then and could be recut 5 times at 3c. each, such good steel! No, they were not recut by hand, but hand cutting was better and this was just as good as new; oh, no, not as good as hand cut. They had special machinery for recutting this special steel; first the teeth were all ground off in big grindstones, that made the special steel soft and smooth; next the file was put between dies in a big hammer and "boom! all the teeth, both sides, all made sharp to one time," then the edges, and last it was oiled up and sent back; yes, it was hard, "the steel do that." Regarding the possibility of securing rake to the teeth on both sides in the same direction at one time, I was advised that nothing was "impossibeel."

On pressing the point I was politely informed that "I do not converse with a workman."

"You do not understand?

"You do not want to buy files, no; you want secrets, yes; but I do not tell, no; and I enjoy my dinner and my wine just so much, if you buy or not buy!" Which was exceedingly ambiguous and might be meant that it was all my loss and my wine was sour anyway, or that there were others to hark to the knock of opportunity.

Say it again: Only reliable products can be continuously advertised.

Yours truly,
W. H. BROOKS,
Supt. Wheeling Can Co.,
Wheeling, W. Va.

* * *

If you need files, buy from the manufacturers who advertise in the AMERICAN MACHINIST.

If you need tools or equipment of any kind, buy that which is advertised in the AMERICAN MACHINIST.

You're safe then.

It's your assurance of satisfaction — permanent satisfaction.

* * *

Only reliable products can be continuously advertised.

In a Nashville Automobile Factory

By Ethan Viall

Crank-case machining, an interesting cylinder boring fixture, and a fixture for milling universal joint parts.

A handy assembling stand and some of the factory inspecting methods.

The Nashville Marathon Motor Works, Nashville, Tenn., maker of the Marathon automobiles, has one of the largest and best equipped machine shops of the South. Between four and five hundred men are employed, and the buildings are large, roomy and well lighted, comparing favorably with similar factories elsewhere. The shop practice and the use of jigs and fixtures are equal to any automobile factory of its size in the country.

The motor used in the cars built in this factory differs considerably from others, as shown in Fig. 1. The aluminum crankcase and flywheel casing are cast in one piece, the bearings for the crankshafts and camshafts being set in and bolted to the ends. The cone-shaped transmission case is set into and is bolted to the flywheel casing, and the outer end carries the bearings for the universal joint of the driving shaft.

Only a few of the shop operations on crank cases, universal joints, cylinders and connecting-rods will be shown, as the others are common standard practice and too well known to be described.

Milling Crank Cases

The cylinder, handhole, frame and magneto pads are milled while the crank cases are held in the fixture shown in Fig. 2. This fixture consists of two brackets *A* and *B* on which are mounted the three-jawed chucks *C* and *D*. These chucks easily center the round ends of the casting and hold it firmly.

No indexing device is used in connection with these chucks, but distance pieces like *E* are depended upon to properly locate and level the casting when setting it. After the case has been set, the chuck bearings are locked by tightening the capscrews. The illustration shows the magneto pad being surfaced off. The case is also milled at *F* for the cylinders at this setting.

Boring

After being milled, the crank cases are placed on a horizontal boring mill, in the fixture shown in Fig. 3 and the various holes bored out. The shaft hole for the magneto drive is being bored in the example shown, and the guide bushing for the bar used to bore the center holes is shown at *A*.

The bar used for the center hole is shown at *A*, Fig. 4, the guide which fits the bushing being shown at *B*. Single-point cutting tools are used to bore with, though a roughing and finishing tool is held in the same holder, as shown at *C* and *D*. At the left is a transmission boring fixture which is used on the same mill as the crank-case fixture. Leveling screws are shown at *E*.

Milling Universal Joints

The drop-forged forks used in the universal joint on the shaft drive are milled radial for block clearance, at the bottom. This, as well as the finishing of the inside of the fork sides, is done in a regular miller, using the fixture shown in Fig. 5.

The fork to be milled is clamped into a bracket *A*, which is part of the swinging arm *B*. This arm is set into the bracket *C* and is held in by the clamps *D*, so that it may be rotated in its bearing. The lower end of the arm *B*, is slotted next to the miller table, and in this slot fits a roller on the bracket *E*, so that as the miller table moves, the arm *B* is swung through a limited arc and the fork, feeding under a cutter, is milled as desired.

Boring Cylinders

Cylinder castings are milled, drilled and then bored out in a two-spindle vertical boring machine, as shown in Fig. 6. The body of this boring fixture remains clamped to the table, but the top plate to which the casting is bolted, is easily removed. While one pair of cylinders is being bored, another casting is being bolted to another top plate, as shown in Fig. 7. Then as soon as the set in the mill is finished, it is removed by loosening two capscrews and the other set is put in its place, the plate being accurately located by means of two large dowel pins in the top of the fixture body, which enter holes in the plate. In this way the boring mill is kept going almost continu-

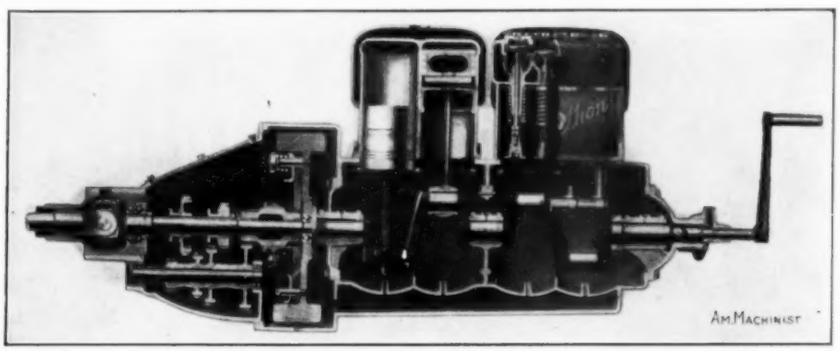


Fig. 1. Marathon Motor and Transmission Construction

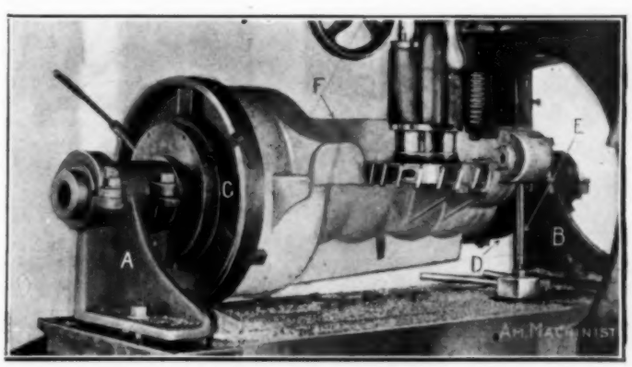


Fig. 2. Crank-case Milling Fixture

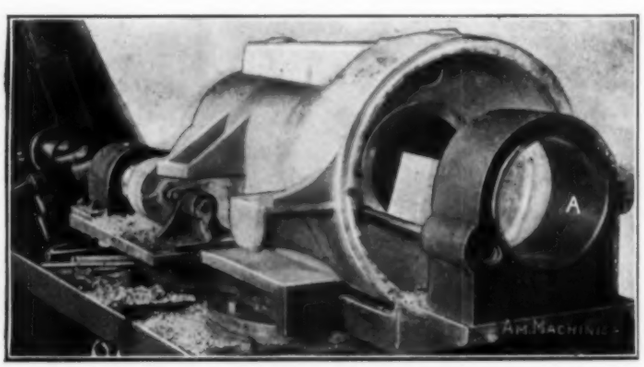


Fig. 3. Crank-case Boring Fixture

ously, the cylinders, of course, being afterward finished by grinding in the usual way.

Finishing Valve Holes

Valve and valve-guide holes are finished in a four-spindle driller, while held in the fixture shown in Fig. 8. The valve holes and seats are first finished, using the bushings in the top piece *A* to guide the tools. Next bushings are fitted to the finished holes, as shown at *B*, and the guide holes are drilled and reamed.

Broaching Connecting-rods

The cast-iron bearings of the disk *A*, Fig. 9, and of the connecting-rods, are broached out in a Lapointe machine, using the type of broach shown. The blank, spirally-grooved places in the broaches, compress the metal between cuttings of the broach teeth. About 0.010 is the difference in size allowed from one end of the broach to the other.

An Assembling Stand

A very convenient type of assembling stand is shown in Fig. 10. The crank case is fastened to this stand by means of a pair of brackets which bolt to the frame pads, as at *A*. The other end of the case is supported in a sling *B*. Wheels at *C* and *D*, under the heaviest end of the stand, make it easy for the workman to shift the motor around for convenience or light.

Inspecting Parts

All parts used in the construction of the cars are carefully inspected and tested many times, special gages being used wherever necessary.

A gaging fixture used to test connect-

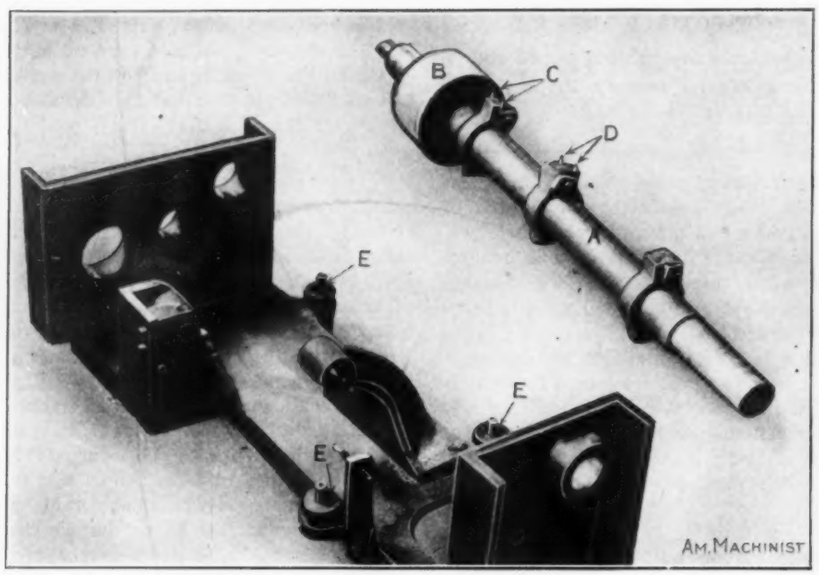


Fig. 4. Crank-case Boring Bar and Transmission Fixture

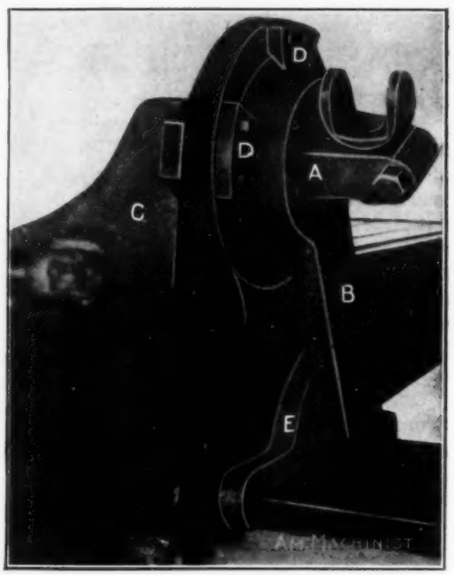


Fig. 5. Radial Milling Fixture

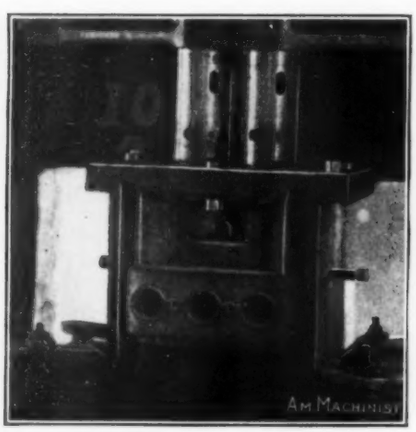


Fig. 6. Cylinder-boring Fixture

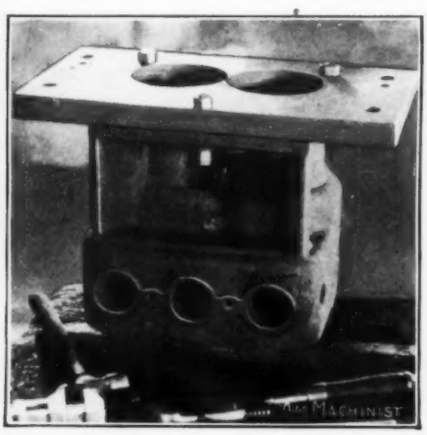


Fig. 7. Removable Top Plate

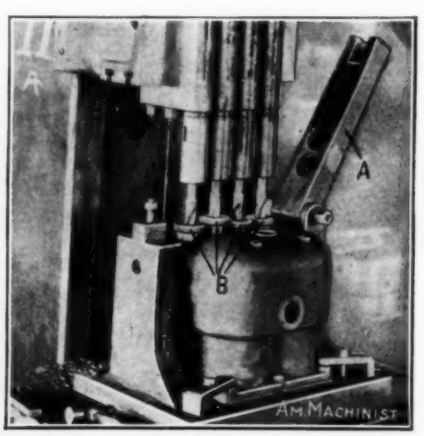


Fig. 8. Valve-hole Fixture

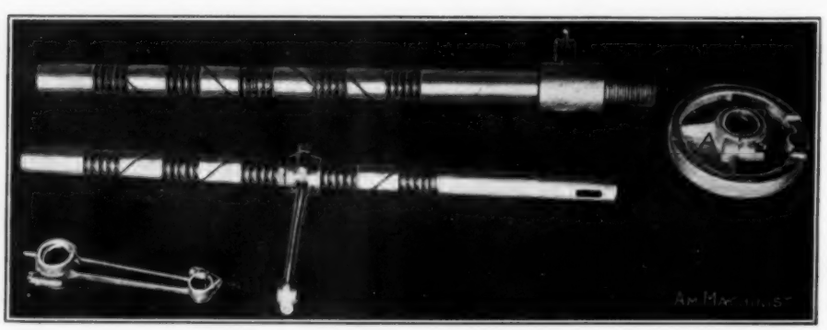


Fig. 9. Type of Broaches Used for Connecting-rods and Other Parts

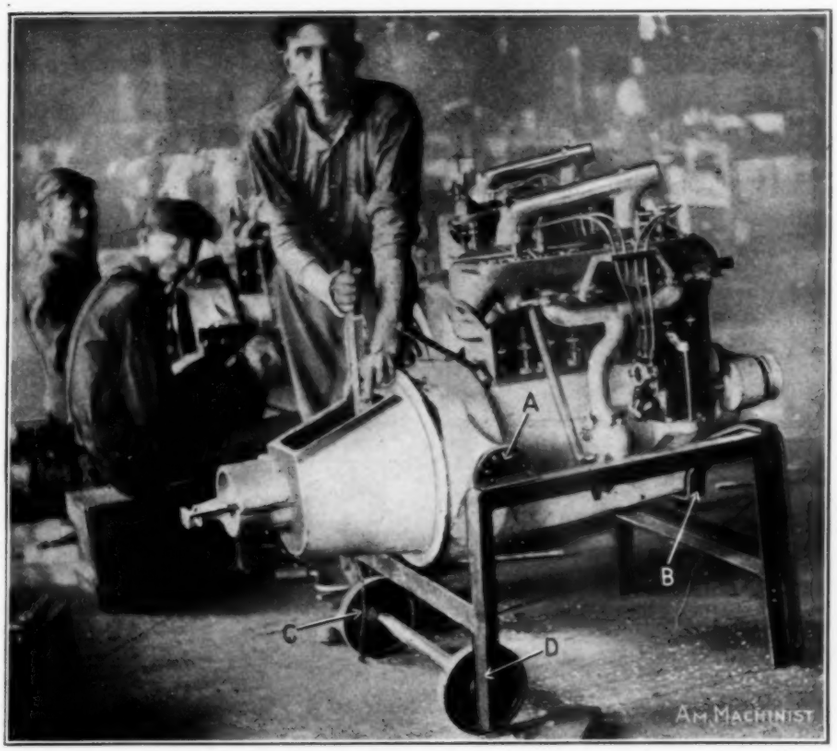


FIG. 10. A CONVENIENT ASSEMBLING STAND

ing-rods is shown in Fig. 11. The bar *A* not only gages the small hole but holds the connecting-rod firmly between the blocks *B* for the other tests. The bar *C*, thrust through the large bearing and resting on the straight-edges *D* and *E*, shows whether there is any wind to the rod. Parallelism of the bearings is tested by means of the two pins *F* mounted on the sliding carriage *G*. This carriage also holds the swinging piece *H* used to test the alignment of the short side of the large bearing.

Camshafts are tested in the fixture shown in Fig. 12, the shaft being placed between centers and the cams tested with an indicator carried in a surface gage, the gage of course resting against and sliding along the edge of the bed. The disk on the end of the shaft is marked with lines for the inlet and exhaust, the correctness of which is tested by means of the pointer *A*, bolted to the head bracket.

For testing pistons, this same fixture is used, but the tailstock is moved up as shown in Fig. 13. The piston is mounted on a mandrel thrust through the wristpin hole. A sliding block *A* holds a post *B* to which the indicator *C* is fastened. This test shows whether the sides of the piston are at right angles to the ore. Other gages are used to test the ring grooves and the diameter.

Doubtful Economy

Hans Schmidt, proprietor of a western Minnesota sawmill, used for fuel the sawdust from the factory. It cost him nothing, but it kept four men busy shoveling it. Recently he was persuaded to put in a new equipment which would reduce the amount of fuel one-half.

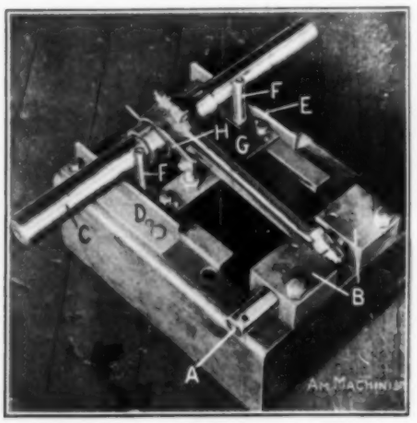


FIG. 11. CONNECTING-ROD GAGING FIXTURE

After the machinery had been installed, the agent called, expecting to be congratulated. But the German eyed him gloomily.

"Doesn't the new plant do all I claimed?" he asked.

"Yah; but I oberlooks sometings," replied Hans.

"What was that?"

"Vell, it dakes only dwo mens to handle de fuel, but it dakes de udder dwo mens to haul away what we don't use und a team pesides."—*Hampton's Magazine.*

There were 38,430 wage earners engaged in connection with the operation of blast furnaces during the year 1909. This was a decrease of 2.1 per cent. compared with 1899.

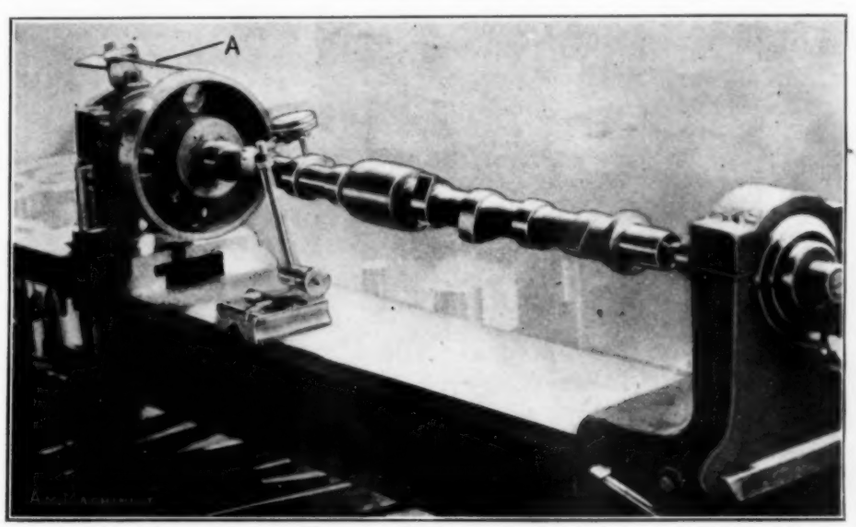


FIG. 12. INSPECTING APPARATUS FOR CAMSHAFTS

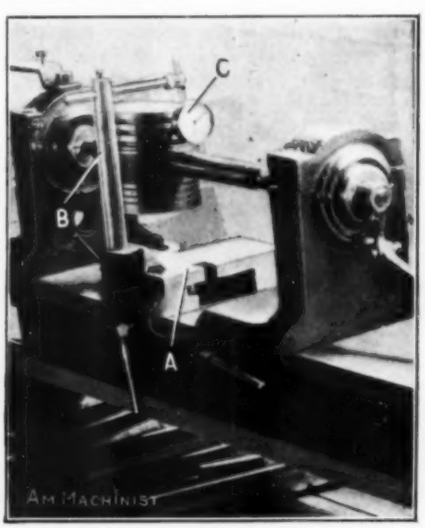


FIG. 13. TESTING PISTONS

Miscellaneous Railroad Shop Tools

Editorial Correspondence

A home-made cutting-off machine for studs and a convenient storage rack for studs of all dimensions. Special air hoist for the wheel lathe; planer fixtures for holding driving boxes on the shoe and wedge faces; pneumatic apparatus for testing pop safety valves.

A good many of the methods and special appliances in use at the 'Frisco railroad shops at Springfield, Mo., have recently been shown in the AMERICAN MACHINIST. In the present article a few attachments for standard machines and some home-made devices not referred to in the former descriptions are illustrated.

HANDY STUD RACKS AND A SHEAR

A pair of racks with compartments for holding studs of every dimension required in the shop is shown in Fig. 1.

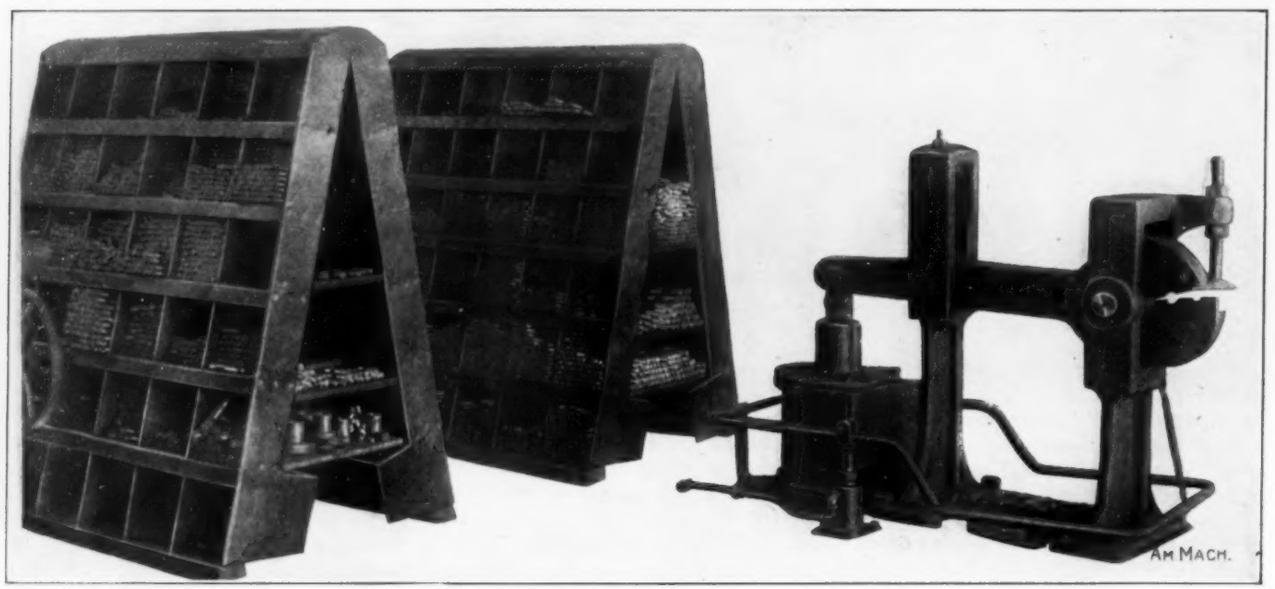


FIG. 1. STUD RACKS AND SHEAR

The threaders are alongside of these racks, and at the right is a shear for cutting stock at any desired length. This machine is operated pneumatically through the medium of the air cylinder and piston at the rear, the control being by means of the continuous foot-rod extending completely around the base. The stock or work is sheared off to length by placing it either between the jaws or in the round die openings behind the fulcrum.

A HOIST FOR THE WHEEL LATHE

The Putnam wheel lathe in Fig. 2 is shown equipped with a pneumatic hoist carried by a trolley on rails across the head and tailstocks. This special hoist was put on the lathe in order to avoid delays in waiting for the regular traveling crane to serve the machine.

As illustrated, the track for the hoist is carried on brackets directly over the center of the lathe, the bracket on the tailstock cap being so constructed as to permit the tailstock to be moved back and forth under the track. Two lengths of 4-in. channel iron form the track. These are spaced 8 in. apart by pieces of ¾-in. pipe at each end, through which two ¾-in. bolts are passed.

The four-wheeled carriage supports the tandem cylinder by means of trunnions which are provided at the cylinder base to permit the wheel hooks to be swung forward to pick up the wheels when these are rolled up to the lathe. When air is applied the wheels are lifted to the right height and hang directly in line with the centers.

This arrangement allows the wheels to

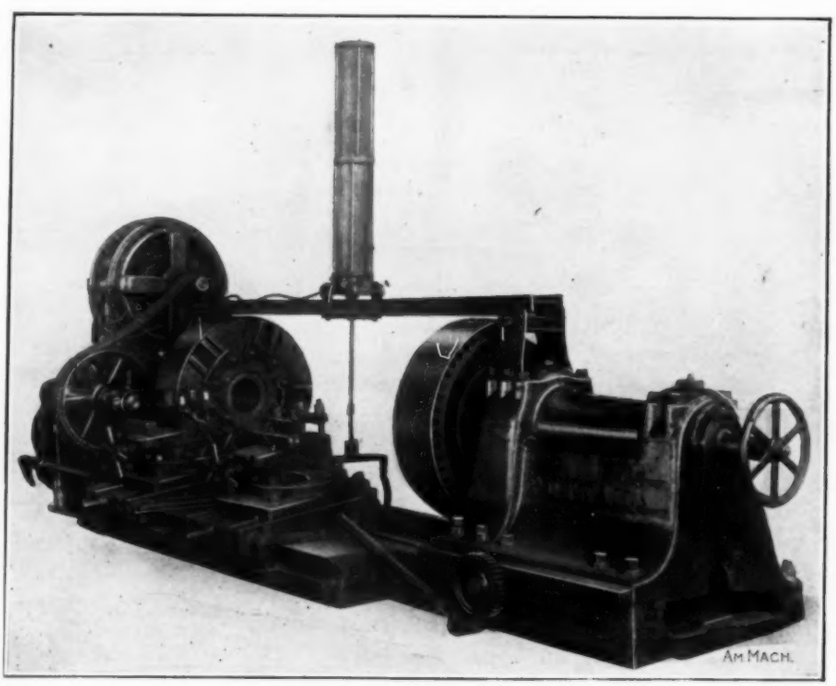


FIG. 2. AIR HOIST ON WHEEL LATHE

be taken hold of in front of the lathe where chucking collets are applied to the journals, thus obviating rolling the wheels on the bed of the machine. A tandem cylinder is used because of occasional low air pressure. With this construction 35 lb. is sufficient for lifting the wheels.

Planer Fixtures for Driving Boxes

The fixtures on the planer in Fig. 3 are for holding driving boxes while the faces and flanges for shoes and wedges are being planed.

At the front of the vertical face of these fixtures will be noticed a longitudinal ledge or rail with a T-slot running the entire length. The driving boxes are placed upon this support and thus rest upon their shoe and wedge faces instead of on their flanges. This results in the two faces being parallel without the application of shims and liners and does away with the planing of the outer edges of the flanges.

The fixture can be made double and both heads used if desired, so that very rapid time can be made in planing up boxes.

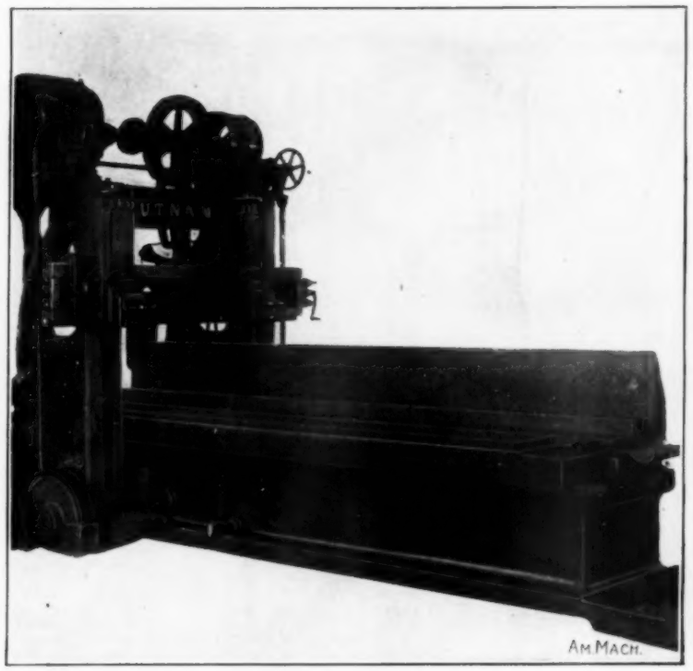


Fig. 3. Planer Fixtures for Driving Boxes

Pneumatic Testing Apparatus

The pneumatic outfit in Fig. 4 is ofr testing pop-safety valves. The reservoir at the right is connected to the shop air line, and its gage indicates the shop line pressure. One connection leads to the reservoir at the left and has a valve to cut out when this reservoir is charged to the shop line pressure of 90 lb. Air is then admitted to the pump and the pressure in the left-hand reservoir is pumped up to 240 lb., to which its safety valve is set.

The air gage on this reservoir is connected to a piece of 2-in. pipe 24 in. long, the lower end having a $\frac{1}{32}$-in. opening, leaving the pressure steady so that the needle of the gage is free from vibration while the pump is working. The operator can thus see exactly how many pounds the valve being tested will lose before popping.

The pop to be tested is fastened to a large gate valve on the front of the left-hand reservoir, various sizes of nipples being used for different makes and sizes. The pops are set from 3 to 5 lb. less than the engine pressure and it is seldom that one requires resetting on the engine.

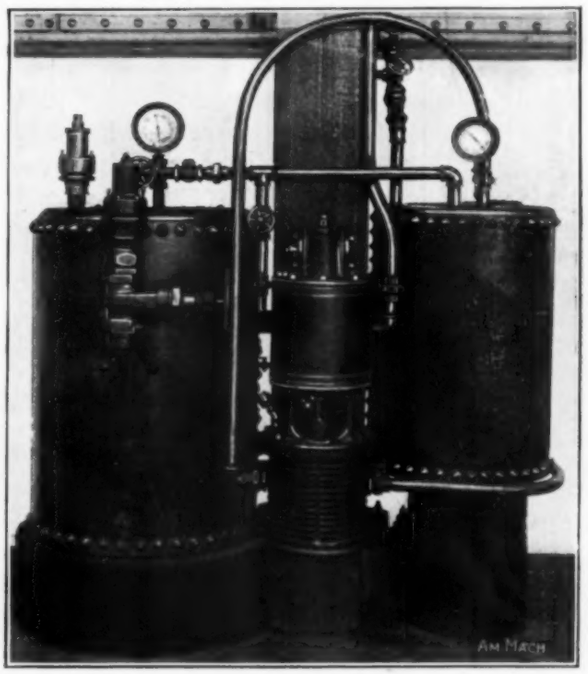


Fig. 4. Apparatus for Testing Pop Valves

Motion Study in the Drafting Room

By F. G. Higbee

There is one matter concerning efficiency in drafting which seems to have been overlooked in the discussions which have appeared in these columns. It is the matter of personal efficiency in technic and in the manipulation of tools. There is a great difference among draftsmen in the order of doing work, in the manner of handling tools and in the arrangement of the tools. All of these factors are elements in determining the speed with which work may be done, and in doing routine drafting, speed is an element of efficiency.

In these respects our friends, the dentists, can give us a point or two. At any rate, the relation of tool trays to the work in hand, the systematic arrangement of their apparatus and tools, and their own position with relation to the work and implements of torture are such as to call forth admiration for their effectiveness. There is no lost motion, there is no false move, and no time wasted. The work progresses smoothly and surely.

There is room for "motion study" in drafting as well as in other crafts. Those draftsmen who have given thought to the elements suggested are fast because they are systematic, and, therefore, deft. But many draftsmen who are not naturally deft at manipulation can readily and quickly increase their rate of production by a thoughtful consideration of the motions they make and the arrangement of their tools on the drafting table.

The estimate that a billion dollars' worth of manufactures will be exported in the current fiscal year, made by the Bureau of Statistics, Department of Commerce and Labor, seems likely to be justified. The official figures show for the 9 months ending with March, 730 million dollars' worth of manufactures exported, these figures being 74 million dollars in excess of those for the corresponding period of the preceding year; and as the exports of manufactures in the year ending June 30, 1911, were valued at 907 million dollars, the figures at hand seem to clearly indicate that the total for the current year will pass the billion dollar line.

Gears for Milling Long Leads

By John R. Dunham

A simple device applied to the miller for cutting long leads with the regular change gears.

A ten-to-one ratio in the box extends the usual range of leads obtainable to an almost unlimited degree.

In operating a universal miller, the operator is very often called upon to cut spirals of various leads which the regular change wheels will not give. This causes numerous delays in waiting for gears to be made to do the work, and at times the lead is so great that it is impossible to gear up the machine without considerable trouble. For this reason the device described was designed.

This box gear was designed for use on a Cincinnati universal miller, but, of course, it may be applied to any miller, though it would probably have to be modified to suit the machine. It will give any lead from 0.067 in. to 1612.5 in., as will be seen in Fig. 1. The gear case is placed upon the end of the miller table. Shaft *A A* is connected by gearing to the gears on the quadrant holding the regular change wheels as usually placed upon the machine. Stud *B* connects with the wormshaft of the dividing head and the gearing between these two points is 10

Lead of Spiral in Inches	Gear on Worm	1st Intermediate Gear	2nd Intermediate Gear	Gear for Screw
0.670	24	86	24	100
0.781	24	86	28	100
0.800	24	72	24	100
0.893	24	86	32	100
0.900	24	64	24	100
0.930	24	72	24	86
0.933	24	72	28	100
1.029	24	56	24	100
1.042	28	86	32	100
1.047	24	64	24	86
1.050	24	64	28	100
1.067	24	72	32	100
1.085	24	72	28	86
1.116	24	86	40	100
1.196	24	56	24	86
1.200	24	64	32	100
1.221	24	64	28	86
1.228	24	86	44	100
1.240	24	72	32	86
1.244	28	72	32	100
1.302	28	86	40	100
1.333	24	72	40	100
1.340	24	86	48	100
1.371	32	56	24	100
1.395	24	64	32	86
1.400	28	64	32	100
1.433	28	86	44	100
1.447	28	72	32	86
1.458	24	64	28	72
1.467	24	72	44	100
1.488	32	86	40	100
1.500	40	64	24	100
1.550	24	72	40	86
1.556	28	72	40	100
1.563	28	86	48	100
1.595	24	56	32	86
1.600	24	72	48	100
1.628	28	64	32	86
1.637	32	86	44	100
1.650	44	64	24	100
1.667	24	64	32	72
1.705	24	72	44	86
1.711	28	72	44	100
1.714	40	56	24	100
1.744	24	64	40	86
1.750	28	64	40	100
1.778	32	72	40	100
1.786	32	86	48	100
1.809	28	72	40	86
1.823	28	100	56	86
1.860	24	72	48	86
1.867	28	72	48	100
1.886	44	56	24	100
1.919	24	64	44	86
1.925	28	64	44	100
1.944	28	64	32	72
1.956	32	72	44	100
1.990	28	72	44	86
1.993	24	56	40	86
2.000	32	64	40	100
2.030	24	44	32	86
2.035	28	64	40	86
2.047	40	86	44	100
2.057	48	56	24	100
2.067	32	72	40	86
2.083	24	64	40	72
2.093	24	64	48	86
2.100	28	64	48	100
2.133	32	72	48	100
2.171	28	72	48	86
2.178	28	100	56	72
2.182	40	44	24	100
2.193	24	56	44	86
2.200	32	64	44	100
2.222	28	56	32	72
2.233	40	86	48	100
2.238	28	64	44	86
2.274	32	72	44	86
2.286	32	56	40	100
2.292	24	64	44	72
2.326	32	64	40	86
2.368	28	44	32	86
2.381	24	56	40	72
2.392	24	56	48	86
2.400	32	64	48	100
2.431	28	64	40	72
2.442	28	64	48	86
2.444	40	72	44	100
2.450	56	64	28	100
2.456	44	86	48	100
2.481	32	72	48	86
2.489	32	100	56	72
2.500	24	64	48	72
2.514	44	56	32	100
2.532	28	72	56	86
2.537	24	44	40	86
2.558	32	64	44	86
2.567	44	48	28	100
2.605	28	40	32	86
2.619	24	56	44	72
2.658	32	56	40	86
2.667	40	72	48	100
2.674	28	64	44	72
2.713	28	48	40	86
2.743	48	56	32	100
2.750	40	64	44	100
2.778	32	64	40	72
2.791	32	64	48	86
2.800	56	64	32	100
2.842	40	72	44	86
2.849	28	64	56	86
2.857	24	56	48	72
2.865	44	100	56	86
2.880	48	40	24	100
2.894	32	72	56	86
2.917	28	64	48	72
2.924	32	56	44	86
2.933	44	72	48	100
2.946	44	56	24	64
2.960	28	44	40	86
2.984	28	48	44	86
3.000	40	64	48	100
3.044	24	44	48	86
3.056	32	64	44	72
3.070	24	40	44	86
3.101	40	72	48	86
3.111	40	100	56	72
3.126	48	100	56	86
3.143	40	56	44	100
3.175	32	56	40	72
3.189	32	56	48	86
3.198	40	64	44	86
3.241	28	48	40	72
3.256	32	64	56	86
3.267	56	48	28	100
3.300	44	64	48	100
3.307	32	72	64	86
3.333	32	64	48	72
3.349	24	40	48	86
3.360	48	40	28	100
3.383	32	44	40	86
3.403	28	64	56	72
3.411	44	72	48	86
3.422	44	100	56	72
3.429	40	56	48	100
3.488	40	64	48	86
3.492	32	56	44	72
3.500	40	100	56	64
3.520	44	40	32	100
3.551	28	44	48	86
3.565	28	48	44	72
3.581	28	40	44	86
3.618	40	72	56	86
3.636	24	44	48	72
3.654	40	56	44	86
3.667	44	48	40	100
3.704	32	48	40	72
3.721	28	56	64	86
3.733	48	100	56	72
3.750	48	64	28	56
3.771	44	56	48	100
3.798	28	48	56	86
3.810	32	56	48	72
3.819	40	64	44	72
3.837	44	64	48	86
3.840	48	40	32	100
3.850	44	100	56	64
3.889	32	64	56	72
3.907	28	40	48	86
3.920	56	40	28	100
3.979	44	72	56	86
3.986	40	56	48	86
4.040	32	44	40	72
4.059	32	44	48	86
4.070	40	64	56	86
4.074	32	48	44	72
4.093	32	40	44	86
4.134	40	72	64	86
4.144	56	44	28	86
4.167	40	64	48	72
4.200	48	100	56	64
4.242	28	44	48	72
4.252	32	56	64	86
4.264	40	48	44	86
4.286	48	64	32	56
4.341	48	72	56	86
4.364	48	44	40	100
4.375	56	48	24	64
4.385	44	56	48	86
4.444	28	56	64	72
4.447	24	64	44	86
4.477	44	64	56	86
4.480	56	40	32	100
4.537	28	48	56	72
4.548	44	72	64	86
4.558	56	40	28	86
4.583	44	64	48	72
4.667	28	40	48	72
4.736	32	44	56	86
4.762	40	56	48	72
4.773	56	44	24	64
4.821	72	56	24	64
4.848	32	44	48	72
4.861	40	64	56	72
4.884	48	64	56	86
4.889	32	40	44	72
4.949	56	44	28	72
4.961	48	72	64	86
5.074	40	44	48	86
5.093	40	48	44	72
5.080	32	56	64	72
5.104	56	48	28	64
5.119	56	56	24	72
5.133	56	48	44	100
5.185	32	48	56	72
5.209	56	40	32	86
5.226	86	64	28	72
5.238	44	56	48	72
5.316	40	56	64	86
5.333	32	40	48	72
5.347	44	64	56	72
5.357	48	64	40	56
5.412	64	44	32	86
5.426	40	48	56	86
5.444	56	40	28	72
5.568	56	44	28	64
5.625	72	48	24	64
5.657	32	44	56	72
5.714	64	48	24	56
5.759	86	56	24	64
5.788	56	72	64	86
5.833	48	64	56	72
5.847	44	56	64	86
5.893	48	64	44	56
5.920	40	44	56	86
5.926	64	48	32	72
5.954	64	40	32	86
5.969	44	48	56	86
5.972	86	48	24	72
6.061	40	44	48	72
6.109	56	44	48	100
6.125	56	40	28	64
6.136	72	44	24	64
6.140	44	40	48	86
6.160	56	40	44	100
6.202	40	48	64	86
6.222	64	40	28	72
6.234	64	44	24	56
6.349	40	56	64	72
6.364	56	44	32	64
6.379	48	56	64	86
6.429	72	56	32	64
6.465	64	44	32	72
6.481	40	48	56	72
6.515	86	44	24	72
6.563	72	48	28	64
6.667	64	56	28	48
6.720	56	40	48	100
6.750	72	40	24	64
6.765	40	44	64	86
6.805	56	32	28	72
6.822	44	48	64	86
6.825	86	56	32	72
6.968	86	48	28	72
6.984	44	56	64	72
7.000	56	40	32	64
7.013	72	44	24	56
7.071	40	44	56	72
7.104	48	44	56	86
7.111	64	40	32	72
7.130	44	48	56	72
7.159	72	44	28	64
7.163	44	40	56	86
7.167	86	40	24	72
7.273	64	44	28	56
7.292	56	64	40	48
7.330	86	44	24	64
7.333	44	40	48	72
7.407	40	48	64	72
7.465	86	64	40	72
7.500	72	48	32	64
7.601	86	44	28	72
7.619	48	56	64	72
7.679	86	64	32	56
7.714	72	40	24	56
7.778	64	32	28	72
7.814	48	40	56	86
7.839	86	48	28	64
7.875	72	40	28	64
7.955	56	64	40	44
7.963	86	48	32	72
8.000	64	40	28	56
8.021	56	64	44	48
8.036	72	64	40	56
8.063	86	40	24	64
8.081	40	44	64	72
8.118	48	44	64	86
8.148	44	48	64	72
8.182	72	44	28	56
8.186	44	40	64	86
8.212	86	64	44	72
8.250	48	64	44	64
8.312	64	56	32	44
8.333	48	32	40	72
8.361	86	40	28	72
8.377	86	44	24	56
8.485	48	44	56	72
8.532	86	56	40	72
8.556	86	44	28	64
8.555	44	40	56	72
8.571	72	56	32	48
8.682	64	48	56	86
8.687	86	44	32	72
8.839	72	64	44	56
8.889	56	28	32	72
8.930	48	40	64	86
8.958	86	56	28	48
9.000	72	40	28	56
9.143	64	40	32	56
9.166	48	32	44	72
9.214	86	40	24	56
9.333	48	40	56	72
9.351	72	56	32	44
9.375	72	64	40	48
9.385	86	56	44	72
9.406	86	40	28	64
9.429	48	56	44	40
9.471	56	44	64	86
9.524	64	56	40	48
9.545	72	48	28	44
9.556	86	40	32	72
9.568	72	56	64	86
9.598	86	64	40	56
9.625	56	64	44	40
9.643	72	64	48	56
9.697	64	48	32	44
9.722	56	32	40	72
9.773	86	44	32	64
9.778	44	40	64	72
9.844	72	32	28	64
9.954	86	48	40	72
10.159	64	28	32	72
10.227	72	64	40	44
10.238	86	56	48	72
10.286	72	40	32	56
10.313	72	64	44	48
10.370	56	48	64	72
10.390	64	56	40	44
10.419	56	40	64	86
10.451	86	64	56	72
10.476	64	56	44	48
10.500	56	64	48	40
10.558	86	64	44	56
10.667	48	40	64	72
10.694	56	32	44	72
10.714	72	56	40	48
10.750	86	40	32	64
10.859	86	44	40	72
10.909	72	48	32	44
10.938	56	32	40	64
10.949	86	48	44	72
11.111	64	32	40	72
11.168	86	44	32	56
11.169	72	48	64	86
11.198	86	64	40	48
11.250	72	32	28	56
11.313	56	44	64	72
11.402	86	44	28	48
11.518	86	64	48	56
11.667	56	32	48	72
11.688	72	56	40	44
11.758	86	32	28	64
11.786	72	56	44	48
11.852	64	24	32	72
12.000	72	40	32	48
12.031	56	32	44	64
12.063	86	56	64	72
12.121	64	48	40	44
12.178	72	44	64	86
12.216	86	64	40	44
12.222	48	24	44	72
12.273	72	64	48	44
12.286	86	40	32	56
12.318	86	64	44	48
12.375	72	40	64	72
12.444	56	40	64	72
12.468	64	56	48	44
12.500	56	28	40	64
12.542	86	40	28	48
12.571	64	56	44	40
12.698	64	28	40	72
12.798	86	56	40	48
12.833	56	48	44	40
12.857	72	28	32	64
12.963	56	24	40	72
13.030	86	48	32	44
13.091	72	40	32	44
13.125	56	32	48	64
13.139	86	40	44	72
13.333	64	32	48	72
13.395	72	40	64	86
13.438	86	32	28	56
13.500	72	64	48	40
13.636	72	48	40	44
13.651	86	28	32	72
13.714	64	56	48	40
13.750	56	28	44	64
13.935	86	24	28	72
13.961	86	56	40	44
13.968	64	28	44	72
14.026	72	56	48	44
14.063	72	32	40	64
14.077	86	56	44	48
14.143	72	56	44	40
14.259	56	24	44	72
14.286	64	32	40	56
14.318	72	64	56	44
14.333	86	40	48	72
14.659	86	64	48	44
14.667	64	48	44	40
14.694	72	28	32	56
14.781	86	64	44	40
14.815	64	24	40	72
14.931	86	32	40	72
15.000	56	28	48	64
15.202	86	44	56	72
15.238	64	28	48	72
15.273	56	44	48	40
15.357	86	28	32	64
15.429	72	56	48	40
15.469	72	32	44	64
15.556	64	32	56	72
15.636	86	40	32	44
15.677	86	64	56	48
15.714	64	32	44	56
15.750	72	64	56	40
15.926	86	48	64	72
16.071	72	32	40	56
16.125	86	64	48	40
16.288	86	48	40	44
16.296	64	24	44	72
16.424	86	32	44	72
16.500	72	48	44	40
16.722	86	40	56	72
16.753	86	56	48	44
16.797	86	32	40	64
16.875	72	32	48	64
16.893	86	56	44	40
16.970	64	48	56	44
17.063	86	28	40	72
17.102	86	64	56	44
17.143	72	56	64	48
17.277	86	28	72	32
17.374	86	44	64	72
17.455	64	44	48	40
17.500	56	24	48	64
17.551	86	28	32	56
17.679	72	56	44	32
17.777	64	28	56	72
17.917	86	32	48	72
17.959	64	28	44	56
18.333	64	48	44	32
18.367	72	28	40	56
18.429	86	56	48	40
18.477	86	32	44	64
18.667	64	48	56	40
18.701	72	56	64	44
18.750	72	32	40	48
18.770	86	28	44	72
18.813	86	64	56	40
19.091	72	48	56	44
19.111	86	40	64	72
19.196	86	32	40	56
19.286	72	32	48	56
19.592	64	28	48	56
19.636	72	44	48	40
19.688	72	32	56	64
19.708	86	48	44	40
19.907	86	24	40	72
20.156	86	64	72	48
20.204	72	28	44	56
20.364	64	44	56	40
20.455	72	32	40	44
20.476	86	56	64	48
20.571	72	56	64	40
20.625	72	48	44	32
20.741	64	24	56	72
20.903	86	32	56	72
20.952	64	24	44	56
21.000	72	48	56	40
21.116	86	32	44	56
21.429	72	28	40	48
21.818	72	48	64	44
21.939	86	28	40	56
22.041	72	28	48	56
22.338	86	56	64	44
22.396	86	32	40	48
22.500	72	28	56	64
22.803	86	48	56	44
22.857	64	24	48	56
22.909	72	44	56	40
23.036	86	56	72	48
23.333	64	48	56	32
23.455	86	44	48	40
23.516	86	64	56	32
23.571	72	28	44	48
23.889	86	32	64	72
24.000	72	48	64	40
24.133	86	28	44	56
24.188	86	64	72	40
24.432	86	32	40	44
24.545	72	44	48	32
24.635	86	48	44	32
24.750	72	40	44	32
25.083	86	48	56	40
25.130	86	56	72	44
25.455	64	44	56	32
25.595	86	28	40	48
25.714	72	56	64	32
26.061	86	48	64	44
26.182	72	44	64	40
26.250	72	48	56	32
26.327	86	28	48	56
26.667	64	28	56	48
26.875	86	28	56	64
27.000	72	40	48	32
27.302	86	28	64	72
27.364	86	44	56	40
27.500	72	24	44	48
27.643	86	56	72	40
27.922	86	28	40	44
28.000	64	40	56	32
28.052	72	28	48	44
28.155	86	28	44	48
28.636	72	44	56	32
28.667	86	48	64	40
29.091	64	28	56	44
29.318	86	48	72	44
29.388	72	28	64	56
29.563	86	40	44	32
29.861	86	24	40	48
30.000	72	48	64	32
30.234	86	64	72	32
30.714	86	56	64	32
30.857	72	28	48	40
31.111	64	24	56	48
31.273	86	44	64	40
31.354	86	48	56	32
31.500	72	40	56	32
31.852	86	24	64	72
32.000	64	28	56	40
32.250	86	48	72	40
32.576	86	24	40	44
32.727	72	44	64	32
32.847	86	24	44	48
33.507	86	28	48	44
33.786	86	28	44	40
33.939	64	24	56	44
34.205	86	44	56	32
34.286	72	28	64	48
34.554	86	56	72	32
35.000	72	24	56	48
35.102	86	28	64	56
35.833	86	48	64	32
35.182	86	44	72	40
36.000	72	40	64	32
36.857	86	28	48	40
37.403	72	28	64	44
37.625	86	40	56	32
38.182	72	24	56	44
39.091	86	44	64	32
39.417	86	24	44	40
39.490	86	28	72	56
40.000	72	24	64	48
40.313	86	48	72	32
40.952	86	28	64	48
41.143	72	28	64	40
41.806	86	24	56	48
42.232	86	28	44	32
43.000	86	40	64	32
43.636	72	24	64	44
43.977	86	44	72	32
44.675	86	28	64	44
45.000	72	28	56	32
45.606	86	24	56	44
46.071	86	28	72	48
47.778	86	24	64	48
48.000	72	24	64	40
48.375	86	40	72	32
49.143	86	28	64	40
50.167	86	24	56	40
50.260	86	28	72	44
51.429	72	28	64	32
52.121	86	24	64	44
53.750	86	28	56	32
55.286	86	28	72	40
57.333	86	24	64	40
58.636	86	24	72	44
60.000	72	24	64	32
61.429	86	28	64	32
62.708	86	24	56	32
64.500	86	24	72	40
69.107	86	28	72	32
71.667	86	24	64	32
80.625	86	24	72	32

TABLE 1. LEADS THAT CAN BE OBTAINED BY USING REGULAR CHANGE GEARS

to 1. This, of course, gives a lead 10 times that given by the regular change wheels on the chart.

The longest cut that can be cut with the change wheels furnished in one turn is 80.625. Very often occasions to use longer leads than this are encountered. A case in point was where the turn was one in 310 in. With the gear box described to cut a lead of 310 in., the miller was geared for one turn in 31 in., with the regular change wheels, the gear box was connected between the quadrant and the dividing head, and the desired lead of 310 in. secured.

The same thing can be done with any lead the chart gives. To increase the lead, suppose we change the two gears *A* and *B* on the lead screw of the miller, Fig. 2, gearing up 2 to 1 (66-33 teeth), we can get a lead when set for 31 in., with reducing gear box attached, of 620 in., and so on up to 1612.5 in. lead. This, of course, will require the regular change wheels for a lead of 80.625 in.

By reversing the gears *A* and *B*, Fig. 2 (33-66 teeth), five times, any lead can be obtained. For example, suppose the machine is set for a lead of 31 in. When the reducing gear box is attached to the machine we get a lead of 155 in., while without the reducing gear box and with gears *A* and *B* set 33 to 66 teeth, we get a lead of 15.50 in. when the change gears are set up for a 31-in. lead. The gears, if reversed, will give a lead of 62 in. when set for a lead of 31 in., and so on throughout the series.

While some of the leads thus obtained

Lead of Spiral in Inches	Gear on Worm	1st Intermediate Gear	2nd Intermediate Gear	Gear for Screw
6.70	24	86	24	100
7.81	24	86	28	100
8.00	24	72	24	100
8.93	24	86	32	100
9.00	24	64	24	100
9.30	24	72	24	86
9.33	24	72	28	100
10.29	24	56	24	100
10.42	28	86	32	100
10.47	24	64	24	86
10.50	24	64	28	100
10.67	24	72	32	100
10.85	24	72	28	86
11.16	24	86	40	100
11.96	24	56	24	86
12.00	24	64	32	100
12.21	24	64	28	86
12.28	24	86	44	100
12.40	24	72	32	86
12.44	28	72	32	100
13.02	28	86	40	100
13.33	24	72	40	100
13.40	24	86	48	100
13.71	32	56	24	100
13.95	24	64	32	86
14.00	28	64	32	100
14.33	28	86	44	100
14.47	28	72	32	86
14.58	24	64	28	72
14.67	24	72	44	100
14.88	32	86	40	100
15.00	40	64	24	100
15.50	24	72	40	86
15.56	28	72	40	100
15.63	28	86	48	100
15.95	24	56	32	86
16.00	24	72	48	100
16.28	28	64	32	86
16.37	32	86	44	100
16.50	44	64	24	100
16.67	24	64	32	72
17.05	24	72	44	86
17.11	28	72	44	100
17.14	40	56	24	100
17.44	24	64	40	86
17.50	28	64	40	100
17.78	32	72	40	100
17.86	32	86	48	100
18.09	28	72	40	86
18.23	28	100	56	86
18.60	24	72	48	86
18.67	28	72	48	100
18.86	44	56	24	100
19.19	24	64	44	86
19.25	28	64	44	100
19.44	28	64	32	72
19.56	32	72	44	100
19.90	28	72	44	86
19.93	24	56	40	86
20.00	32	64	40	100
20.30	24	44	32	86
20.35	28	64	40	86
20.47	40	86	44	100
20.57	48	56	24	100
20.67	32	72	40	86
20.83	24	64	40	72
20.93	24	64	48	86
21.00	28	64	48	100
21.33	32	72	48	100
21.71	28	72	48	86
21.78	28	100	56	72
21.82	40	44	24	100
21.93	24	56	44	86
22.00	32	64	44	100
22.22	28	56	32	72
22.33	40	86	48	100
22.38	28	64	44	86
22.74	32	72	44	86
22.86	32	56	40	100
22.92	24	64	44	72
23.26	32	64	40	86
23.68	28	44	32	86
23.81	24	56	40	72
23.92	24	56	48	86
24.00	32	64	48	100
24.31	28	64	40	72
24.42	28	64	48	86
24.44	32	72	44	100
24.50	56	64	28	100
24.81	32	72	48	86
24.89	32	100	56	72
25.00	24	64	48	72
25.14	44	56	32	100
25.32	28	72	56	86
25.37	24	44	40	86
25.58	32	64	44	86
25.67	44	48	28	100
26.05	28	40	32	86
26.19	24	56	44	72
26.58	32	56	40	86
26.67	40	72	48	100
26.74	28	64	44	72
27.13	28	48	40	86
27.43	48	56	32	100
27.50	40	64	44	100
27.78	32	64	40	72
27.91	32	64	48	86
28.00	56	64	32	100
28.42	40	72	44	86
28.49	28	64	56	86
28.57	24	56	48	72
28.65	44	100	56	86
28.80	48	40	24	100
28.94	32	72	56	86
29.17	28	64	48	72
29.24	32	56	44	86
29.33	44	72	48	100
29.46	44	56	24	64
29.60	28	44	40	86
29.84	28	48	44	86
30.00	40	64	48	100
30.44	24	44	48	86
30.56	32	64	44	72
30.70	24	40	44	86
31.01	40	72	48	86
31.11	40	100	56	72
31.26	48	100	56	86
31.43	40	56	44	100
31.75	32	56	40	72
31.89	32	56	48	86
31.98	40	64	44	86
32.41	28	48	40	72
32.56	32	64	56	86
32.67	56	48	28	100
33.00	44	64	48	100
33.07	32	72	64	86
33.33	32	64	48	72
33.49	24	40	48	86
33.60	48	40	28	100
33.83	32	44	40	86
34.03	28	64	56	72
34.11	44	72	48	86
34.22	44	100	56	72
34.29	40	56	48	100
34.88	40	64	48	86
34.92	32	56	44	72
35.00	40	100	56	64
35.20	44	40	32	100
35.51	28	44	48	86
35.65	28	48	44	72
35.81	28	40	44	86
36.18	40	72	56	86
36.36	24	44	48	72
36.54	40	56	44	86
36.67	44	48	40	100
37.04	32	48	40	72
37.21	28	56	64	86
37.33	48	100	56	72
37.50	48	64	28	56
37.71	44	56	48	100
37.98	28	48	56	86
38.10	32	56	48	72
38.19	40	64	44	72
38.37	44	64	48	86
38.40	48	40	32	100
38.50	44	100	56	64
39.07	28	40	48	86
39.20	56	40	28	100
39.79	44	72	56	86
39.86	40	56	48	86
40.40	32	44	40	72
40.59	32	44	48	86
40.70	40	64	56	86
40.74	32	48	44	72
40.93	32	40	44	86
41.34	40	72	64	86
41.44	56	44	28	86
41.67	40	64	48	72
42.00	48	100	56	64
42.42	28	44	48	72
42.52	32	56	64	86
42.64	40	48	44	86
42.86	48	64	32	56
43.41	48	72	56	86
43.64	48	44	40	100
43.65	40	56	44	72
43.75	56	48	24	64
43.85	44	56	48	86
44.44	28	56	64	72
44.65	32	40	48	86
44.77	44	64	56	86
44.80	56	40	32	100
45.37	28	48	56	72
45.48	44	72	64	86
45.58	56	40	28	86
45.83	44	64	48	72
46.67	28	40	48	72
47.36	32	44	56	86
47.62	40	56	48	72
47.73	56	44	24	64
48.21	72	56	24	64
48.48	32	44	48	72
48.61	40	64	56	72
48.84	64	56	48	86
48.89	32	40	44	72
49.49	56	44	28	72
49.61	48	72	64	86
50.74	40	44	48	86
50.80	32	56	64	72
50.93	40	48	44	72
51.04	56	48	28	64
51.33	56	48	44	100
51.85	32	48	56	72
52.09	56	40	32	86
52.26	56	64	28	72
52.38	44	56	48	72
53.16	40	56	64	86
53.33	32	40	48	72
53.47	44	64	56	72
53.57	48	64	40	56
54.12	64	44	32	86
54.26	40	48	56	86
54.44	56	40	28	72
55.68	56	44	28	64
56.25	72	48	24	64
56.57	32	44	56	72
57.14	64	48	24	56
57.59	86	56	24	64
57.88	56	72	64	86
58.33	48	64	56	72
58.47	44	56	64	86
58.93	48	64	44	56
59.20	40	44	56	86
59.26	64	48	32	72
59.54	64	40	32	86
59.69	44	48	56	86
59.72	86	48	24	72
60.61	40	44	48	72
61.09	56	44	48	100
61.25	56	40	28	64
61.36	72	44	24	64
61.40	44	40	48	86
61.60	56	40	44	100
62.02	40	48	64	86
62.22	64	40	28	72
62.34	64	44	24	56
63.49	40	56	64	72
63.64	56	44	32	64
63.79	48	56	64	86
64.29	72	56	32	64
64.65	64	44	32	72
64.81	40	48	56	72
65.15	86	44	24	72
65.63	72	48	28	64
66.67	64	56	28	48
67.20	56	40	48	100
67.50	72	40	24	64
67.65	40	44	64	86
67.90	72	40	28	56
68.06	56	32	28	72
68.22	44	48	64	86
68.25	86	56	32	72
69.68	86	48	28	72
69.84	44	56	64	72
70.00	56	40	32	64
70.13	72	44	24	56
70.71	40	44	56	72
71.04	48	44	56	86
71.11	64	40	32	72
71.30	44	48	56	72
71.59	72	44	28	64
71.63	44	40	56	86
71.67	86	40	24	72
72.73	64	44	28	56
72.92	56	64	40	48
73.30	86	44	24	64
73.33	44	40	48	72
74.07	40	48	64	72
74.65	86	64	40	72
75.00	72	48	32	64
76.01	86	44	28	72
76.19	48	56	64	72
76.79	86	64	32	56
77.14	72	40	24	56
77.78	64	32	28	72
78.14	48	40	56	86
78.39	86	48	28	64
78.75	72	40	28	64
79.55	56	64	40	44
79.63	86	48	32	72
80.00	64	40	28	56
80.21	56	64	44	48
80.36	72	64	40	56
80.63	86	40	24	64
80.81	40	44	64	72
81.18	48	44	64	86
81.48	44	48	64	72
81.82	72	44	28	56
81.86	44	40	64	86
82.12	86	64	44	72
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83.61	86	40	28	72
83.77	86	44	24	56
84.85	48	44	56	72
85.32	86	56	40	72
85.56	86	44	28	64
85.55	44	40	56	72
85.71	72	56	32	48
86.82	64	48	56	86
86.87	86	44	32	72
88.39	72	64	44	56
88.89	56	28	32	72
89.30	48	40	64	86
89.58	86	56	28	48
90.00	72	40	28	56
91.43	64	40	32	56
91.66	48	32	44	72
92.14	86	40	24	56
93.33	48	40	56	72
93.51	72	56	32	44
93.75	72	64	40	48
93.85	86	56	44	72
94.06	86	40	28	64
94.29	48	56	44	86
94.71	56	44	64	86
95.24	64	56	40	48
95.45	72	48	28	44
95.56	86	40	32	72
95.68	72	56	64	86
95.98	86	64	40	56
96.25	56	64	44	40
96.43	72	64	48	56
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97.73	86	44	32	64
97.78	44	40	64	72
98.44	72	32	28	64
99.54	86	48	40	72
101.59	64	28	32	72
102.27	72	64	40	44
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102.86	72	40	32	56
103.13	72	64	44	48
103.70	56	48	64	72
103.90	64	56	40	44
104.19	56	40	64	86
104.51	86	64	56	72
104.76	64	56	44	48
105.00	56	64	48	40
105.58	86	64	44	56
106.67	48	40	64	72
106.94	56	32	44	72
107.14	72	56	40	48
107.50	86	40	32	64
108.59	86	44	40	72
109.09	72	48	32	44
109.38	56	32	40	64
109.49	86	48	44	72
111.11	64	32	40	72
111.68	86	44	32	56
111.69	72	48	64	86
111.98	86	64	40	48
112.50	72	32	28	56
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114.02	86	44	28	48
115.18	86	64	48	56
116.67	56	32	48	72
116.88	72	56	40	44
117.58	86	32	28	64
117.86	72	56	44	48
118.52	64	24	32	72
120.00	72	40	32	48
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120.63	86	56	64	72
121.21	64	48	40	44
121.78	72	44	64	86
122.16	86	64	40	44
122.22	48	24	44	72
122.73	72	64	48	44
122.86	86	40	32	56
123.18	86	64	44	48
123.75	72	40	44	64
124.44	56	40	64	72
124.68	64	56	48	44
125.00	56	28	40	64
125.42	86	40	28	48
125.71	64	56	44	40
125.25	64	56	32	48
126.98	64	28	40	72
127.98	86	56	40	48
128.33	56	48	44	40
128.57	72	28	32	64
129.63	56	24	40	72
130.30	86	48	32	44
130.91	72	40	32	44
131.25	56	32	48	64
131.39	86	40	44	72
133.33	64	32	48	72
133.95	72	40	64	86
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135.00	72	64	48	40
136.36	72	48	40	44
136.51	86	28	32	72
137.14	64	56	48	40
137.50	56	28	44	64
139.35	86	24	28	72
139.61	86	56	40	44
139.68	64	28	44	72
140.26	72	56	48	44
140.63	72	32	40	64
140.77	86	56	44	48
141.43	72	56	44	40
142.59	56	24	44	72
142.86	64	32	40	56
143.18	72	64	56	44
143.33	86	40	48	72
146.59	86	64	48	44
146.67	64	48	44	40
146.94	72	28	32	56
147.81	86	64	44	40
148.15	64	24	40	72
149.31	86	32	40	72
150.00	56	28	48	64
152.02	86	44	56	72
152.38	64	28	48	72
153.57	86	28	32	64
154.29	72	56	48	40
154.69	72	32	44	64
155.56	64	32	56	72
156.36	86	40	32	44
156.77	86	64	56	48
157.14	64	32	44	56
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191.11	86	40	64	72
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195.92	64	28	48	56
196.36	72	44	48	40
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197.08	86	48	44	40
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201.56	86	64	72	48
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210.00	72	48	56	40
211.16	86	32	44	56
214.29	72	28	40	48
218.18	72	48	64	44
219.39	86	28	40	56
219.89	86	64	72	44
220.41	72	28	48	56
223.38	86	56	64	44
223.96	86	32	40	48
225.00	72	28	56	64
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235.16	86	64	56	32
235.71	72	28	44	48
238.89	86	32	64	72
240.00	72	48	64	40
241.33	86	28	44	56
241.88	86	64	72	40
244.32	86	32	40	44
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247.50	72	40	44	32
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251.30	86	56	72	44
254.55	64	44	56	32
255.95	86	28	40	48
257.14	72	56	64	32
260.61	86	48	64	44
261.82	72	44	64	40
262.50	72	48	56	32
263.27	86	28	48	56
266.67	64	28	56	48
268.75	86	28	56	64
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273.64	86	44	56	40
275.00	72	24	44	48
276.43	86	56	72	40
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298.61	86	24	40	48
300.00	72	48	64	32
302.34	86	64	72	32
307.14	86	56	64	32
308.57	72	28	48	40
311.11	64	24	56	48
312.73	86	44	64	40
313.54	86	48	56	32
315.00	72	40	56	32
318.52	86	24	64	72
320.00	64	28	56	40
322.50	86	48	72	40
325.76	86	24	40	44
327.27	72	44	64	32
328.47	86	24	44	48
335.07	86	28	48	44
337.86	86	28	44	40
339.39	64	24	56	44
342.05	86	44	56	32
342.86	72	28	64	48
345.54	86	56	72	32
350.90	72	24	56	48
351.02	86	28	64	56
351.82	86	44	72	40
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360.00	72	40	64	32
368.57	86	28	48	40
374.03	72	28	64	44
376.25	86	40	56	32
381.82	72	24	56	44
390.91	86	44	64	32
394.17	86	24	44	40
394.90	86	28	72	56
400.00	72	24	64	48
403.13	86	48	72	32
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411.43	72	28	64	40
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430.00	86	40	64	32
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514.29	72	28	64	32
521.21	86	24	64	44
537.50	86	28	56	32
552.86	86	28	72	40
573.33	86	24	64	40
586.36	86	24	72	44
600.00	72	24	64	32
614.29	86	28	64	32
627.08	86	24	56	32
645.00	86	24	72	40
691.07	86	28	72	32
761.67	86	24	64	32
806.25	86	24	72	32

TABLE 2. LEADS THAT CAN BE OBTAINED BY USING GEAR REDUCING BOX AND REGULAR CHANGE GEARS

will be the same as those on the chart, a great many of them come in between the charted leads. For the longer leads these seem to be without number, considering the short leads; for example, 0.670, the shortest are regularly given, same change gears. It can thus be seen that almost any lead can be had without waiting for gears to be made.

The table is similar to the one furnished with the miller. Table 2 gives leads 10 times those in Table 1, and is

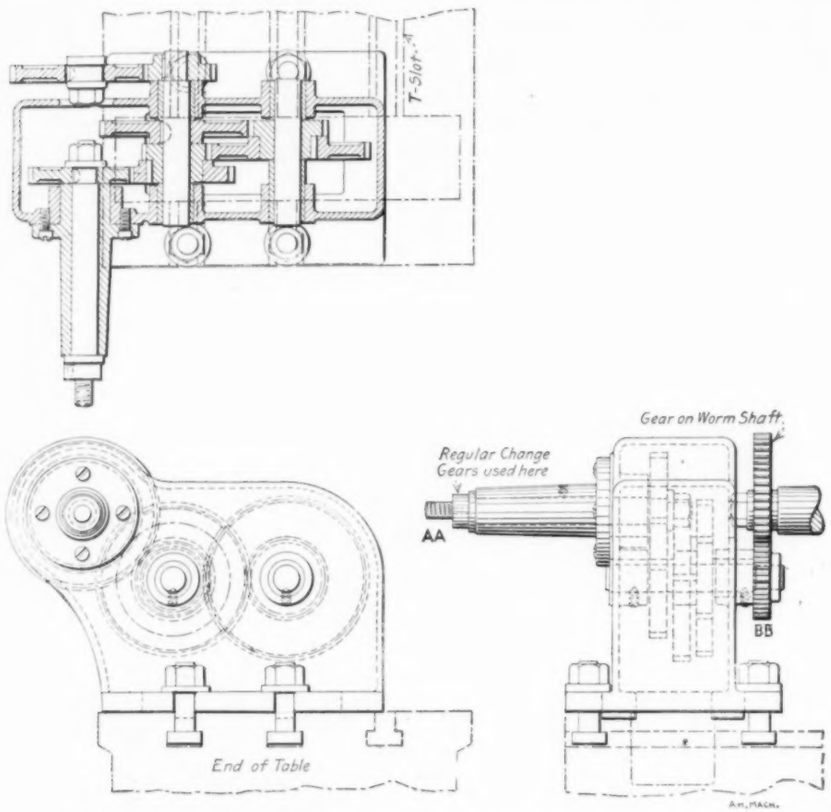


FIG. 1. REDUCING GEAR BOX FOR CUTTING LONG LEADS ON THE MILLER

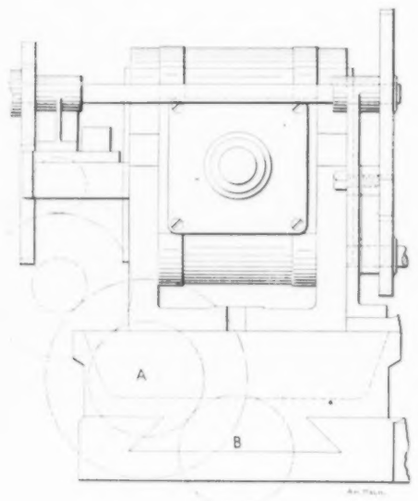


FIG. 2. GEARS BETWEEN DIVIDING HEAD AND TABLE SCREW

the gears *A* and *B* on the screw set 33-66 teeth, or 66-33 teeth will give a lead of 3.35 and 13.40 in., respectively, and with the reducing gear box, and by transposing the gears for the screw, the leads will be 67, 6.70, 3.35 and 13.40 in., all with the for use when the reducing gear box is in service.

An Interesting Shrink Repair

BY EUGENE W. KNOWLTON

Some time ago we had what seemed at first to be a complicated and troublesome repair to make on a large steam hammer, but the repair was accomplished with comparative ease.

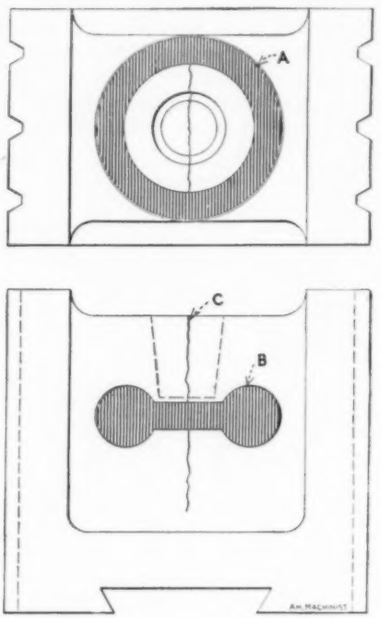
The hammer showed a crack at *C* for some weeks and finally we took it down and on washing it off found that the crack extended clear across the hammer and almost its entire length.

A sweep was made for one of our Lucas horizontal boring mills and we cut a circular groove, about 3 in. in cross-section, in the top of the hammer, and shrunk a ring over the boss left around the taper hole, as shown at *A*.

This was an easy and quick job in comparison with the one that came later, i.e., the dumb-bell shaped piece shown at *B* which was a different job.

Two holes were bored on the radial driller about 5 in. in diameter and 3 in. deep, with about 18-in. centers. Measurements were taken and the proper allowance made for the expansion of the piece which was to be fitted in later on.

The hammer was then put on the planer and the holes connected as shown. The dumb-bell was forged out, the cen-



REPAIRING A BROKEN 1800-LB. HAMMER

ters were laid off, a dividing head rigged up on a planer and the two ends were planed to their correct diameters, which was 1/64 in. less than the diameter of the holes in the head; 1/64 in. was also allowed on the width of the bar connecting the round ends. This bar is about 2½ in. wide and 3 in. thick.

Both these pieces were heated higher than necessary so that we might lay them in place and wait for gravity to do its part for us. The dumb-bell was only heated at the connecting bar, the ends being kept as cool as possible.

Both these shrinks worked perfectly and the hammer was still working satisfactorily the last time I saw it, which was over a year after the repair.

At the April meeting of the New England Foundrymen's Association, Franklin H. Wentworth discussed the prevention of fire waste, laying stress on the laying out of automatic sprinkler systems. This calls for painstaking engineering work, based upon careful planning to meet the conditions imposed by the several boards of underwriters, and to get the best possible value out of the plant as installed. For this reason manufacturers of sprinkler heads much prefer to put in their own installations rather than to let pipe fitters or outside concerns handle the jobs. An experienced and well-trained engineering corps in this line will naturally secure a higher efficiency than is otherwise possible.

Some Operations in a Pump Factory

By F. A. Stanley

Interesting methods in an Iowa establishment where small pump cylinders are bored on a special three-spindle vertical machine and polished out on another home-made machine which handles two cylinders at once.

The turret tools in this shop include an expanding appliance for fixing brass liners in cylinders and a combined hollow mill and die head so arranged that while one set of blades is at work the others are opened out of the way.

The Dempster Manufacturing Co., Des Moines, Iowa, produces among other appliances a line of pumps for household and farm use. Some of the operations in machining cylinders for such pumps are shown.

The cylinders for the various pumps range in diameters from 2 to 4 in. and in lengths from 8 to 16 in. These cylinders, in the cheaper grades of pumps, are simply polished out inside in a machine which will be described later, the surface thus produced being very smooth, so that while the bore may not be exactly cylindrical it is in a suitable condition for the satisfactory operation of the cup leather which lifts the water.

As a matter of fact, all of the cylinders for the various grades of pumps are made with oiled sand cores and consequently the bores of the castings as they come from the foundry are quite smooth, close to size, and nearly cylindrical in outline.

The cylinders of the better grades of pumps are first bored on a special machine and then placed in the polishing machine referred to above for the finishing of the interior. On a higher grade still the bored cylinder is lined with a brass sleeve which is pressed in lightly and secured by expanding the ends.

Boring the Cylinders

A home-made machine for boring pump cylinders, three at a time, is shown in Fig. 1. The machine is of the vertical type with three sliding carriers for the work and three boring bars fixed against end movement while in use, but rotated by spindles which are driven by bevel gears at their upper ends, a shaft with three bevel driving pinions extending across the top of the machine. This driving shaft is itself actuated by spur gearing and a cone pulley at the left side of the machine.

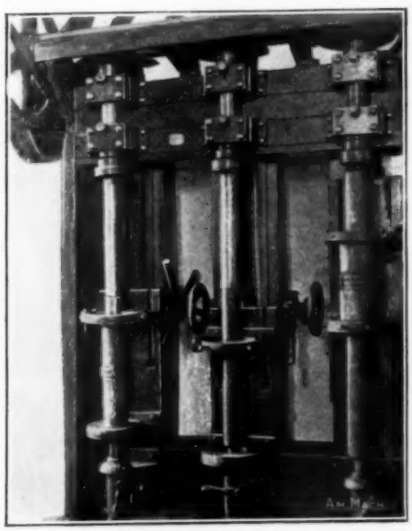


Fig. 1. Boring Pump Cylinders

The cutter bars are squared at their upper ends and enter sockets of similar section formed in the lower ends of the short driving spindles. At their lower ends the bars run upon cone centers, which are adjusted by handwheels the same as the tail center of a lathe.

The vertical carriages for the work are provided with two brackets at the ends which are bored out to receive the cylinder ends and fitted with clamp screws for holding the work. The power vertical feed which carries the work up over the bars is composed of a rack and pinion with the latter driven by a wormwheel and wormshaft from bevel gears on the main shaft over the top of the machine. There is a separate feed drive for each of the three work slides. The latter are, of course, counterbalanced. The boring bars carry double-end cutters and ordinarily only one cut is taken through a cylinder.

The Polishing Machine

The polishing machine, Fig. 2, for the bore of the pump cylinders is another special design with some interesting features.

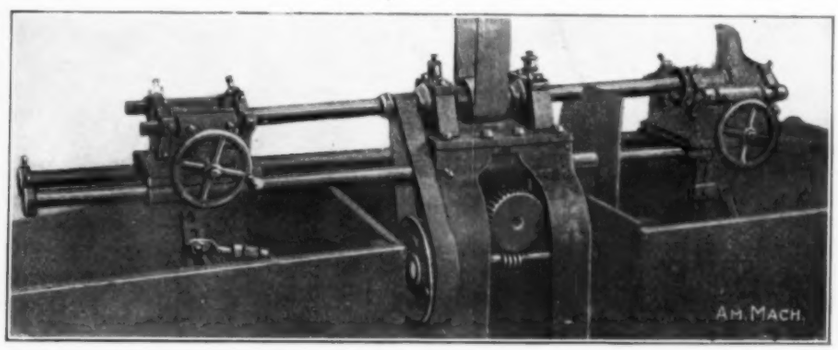


Fig. 2. Cylinder-polishing Machine

This machine is of double-end construction so that two cylinders may be operated upon simultaneously, or one may be removed and another put in its place while the cylinder at the other end is being finished. It consists primarily of a rapidly rotating spindle, which carries at each end a pair of rectangular sticks of abrasive, and of two reciprocating carriages which pass the work to and fro over the polishing medium. The drive for the carriages is derived from the main spindle, from which a belt leads off to a pulley which acts through a worm and wormwheel to revolve a crankshaft under the bed. A connecting rod from this crankshaft to each of the work carriages gives the reciprocating movement required.

The cylinders to be polished out are moved back and forth over the emery heads about eight times per minute. The two emery sticks at each end of the spindle are so mounted that they are always pressed against the interior of the work, and as they are about 3½ in. long the surface upon which they act is soon given the desired degree of polish.

Turret Tools

Two interesting operations accomplished with special turret tools are represented in Figs. 3 and 4. The first of these shows a method of fixing a brass liner in a pump cylinder by expanding the ends as referred to elsewhere.

As already stated, such cylinders as are to be brass lined are first bored in the three-cylinder machine, then they are ready for the turret lathe processes. The ends of the cylinder are bellmouthed by running in a flat cutter carried in a holder in the turret; then the liner, which is a piece of brass tubing cut to length, is placed in the end of the bore and pressed into place lightly. The expanding tool is next brought into service. It is of the form shown clearly in Fig. 3 where one of these tools is seen in place in the end of the work and another of similar design will be noticed standing upright upon the turret.

The expander is made up of three or four hard steel rolls equally spaced about a cone-shaped head and mounted to revolve upon their axes freely. When brought into contact with the end of the brass liner inserted in the pump cylinder the rollers quickly expand the metal into the bell mouth of the bore and thus fix the liner against possibility of accidental movement in its seat.

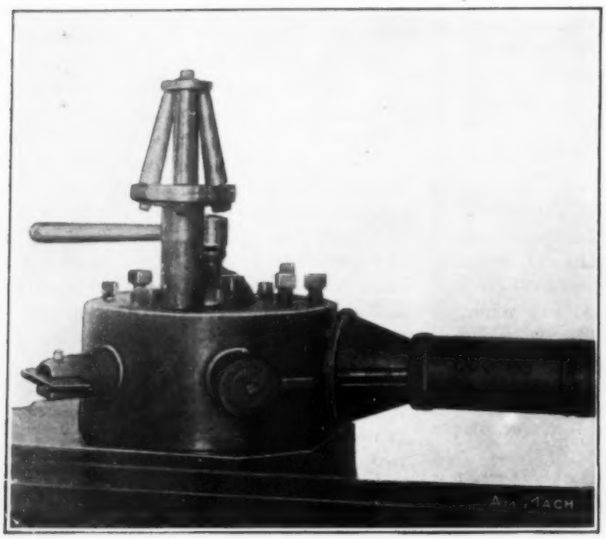


FIG. 3. AN EXPANDING TOOL USED IN THE TURRET

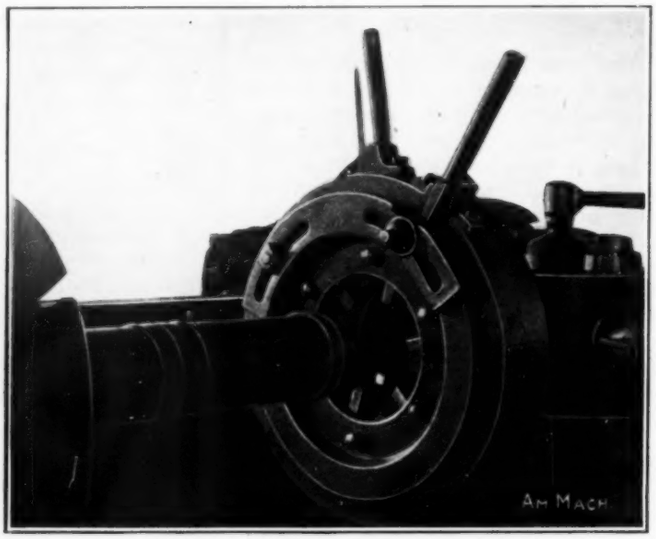


FIG. 4. COMBINATION HOLLOW MILL AND OPENING DIE

The thread upon the end of the pump cylinder shown in Figs. 2 and 4 is cut with the combination head seen in the latter view. This tool carries a set of opening chasers and a set of turning blades which act as a hollow mill for sizing the end of the casting before the die head is run on. The ends of the turning blades are shouldered to face the end of the work at the same time that it is reduced to size for threading.

A Method of Making Gears

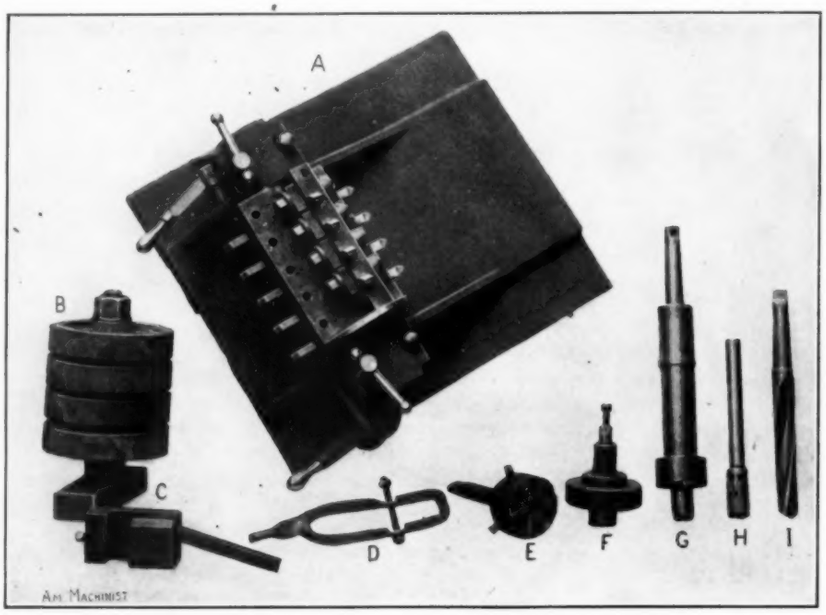
BY GEORGE E. RANDLES*

The gears are first chucked on a drilling machine which is fitted with a geared scroll chuck. The casting is drilled from the core with a three-lip drill and reamed, using the drill *I*, and the reamer *H*, which is adjustable. The hub of the gear is then faced with the roughing and finishing cutter *G*. We use Presto collets for these operations with the exception of the three-lip drilling operation.

The next process is to remove the chuck from the table and clamp the stud *F* in position. The gear is then placed on the stud and held from turning by the clamp *D*. The outside of the hub is then faced to a stop with two facing cutters, one roughing and finishing as indicated at *E*. These facing cutters are made hollow and guide on the small part of the stud for holding the gear and come to a stop on the set-screw located at the top of this stud. This makes it possible to face, perfectly square with the opposite side, which bears against the shoulder, and as the gears are simply held by the clamp *D*, there is no chance for a cramp and not getting the sides true with each other. The gears are first keyeated, then placed on a keyed arbor with space collars between each, as indicated by *C*. This is then put on a 24-in. lathe with the fixture, as indicated at *A*.

The first operation (the illustration shows the tools in position for this) is to take a rough cut over the top of the gears. The second operation is to finish this cut. The next step is to come down with the five tools facing between the gears and on the outer edges, with a roughing cut and the same operation for the finishing cut. These tools are rotated on their turrets, being held securely by plungers at each end and located by a lock-bolt and further clamped by the ball handles.

This completes the gears which come from this turning attachment ready for cutting on the gear cutters, after which they are polished to remove the burrs and tools marks.



A METHOD OF MAKING GEARS

The attachment *C* is a stop, clamped to the bed of the lathe, which swings out of the way for the turning operations and comes back into position to bring the carriage up to a certain position for the facing.

A 24-in. powerfully geared lathe is used for this work.

*Vice-President, The Foote-Burt Co., Cleveland, Ohio.

The Design of Large Lifting-bails

By Axel K. Pedersen

The method given, although only approximate, is sufficiently close for all practical purposes and affords a comparatively easy solution of the problem of design.

In a modern shop the portable tool bears a prominent part in the efficient machining of the work. As a means of carrying the tool to and from the work, large lifting bails are employed. These are usually made from round stock and provided with lugs for bolting them to the sides of the machines.

The exact analytical calculation of the stresses occurring in the bail is rather complicated, and on account of the great variety in the design and outline, it is impractical to plot charts covering all cases. In the following, therefore, a method is given which, though only approximate, is sufficiently close for all practical purposes and affords a comparatively easy and quick solution of the problem in question.

For reasons presently to be explained, the bail provided with lugs is called a fixed lifting bail, see Fig. 1. On the other hand, a bail, which at its ends is provided with eyes, as shown in Fig. 2, is designated a hinged lifting bail; this latter is not often employed for portable tools, but is frequently used in general lifting devices. In both cases, the part to be lifted offers a horizontal resistance Q on the ends of the bail, the part itself preventing any horizontal movement. Otherwise there is a fundamental difference which must be considered in the analysis.

For Fig. 1, the lug is securely clamped to the machine, thus preventing any change in the angle β_1, before and after lifting; i.e., the bail is "fixed" at its ends by the lugs. The bail in Fig. 2 on the contrary is free to turn upon its bolt as a hinge, when lifting, thereby creating a change in the angle β_2. In the following, we shall treat each case separately.

The Fixed Lifting Bail

The condition that no horizontal displacement is possible, requires a horizontal reaction Q; again, the condition that the angle β_1 remains unchanged, is satisfied by introducing a bending moment m, which is constant along the bail.

When the span is large in proportion to the diameter d of the section, which is assumed constant, we have the following formulas for determining the quantities, Q and m:

$$Q = W \cdot \frac{k(a_1b_1 + a_2b_2 + \ldots) - (a_1 + a_2 + \ldots)(b_1 + b_2 + \ldots)}{k(b_1^2 + b_2^2 + \ldots) - (b_1 + b_2 + \ldots)^2} \qquad (1)$$

$$m = x \cdot \frac{Q(b_1^2 + b_2^2 + \ldots) - W(a_1b_1 + a_2b_2 + \ldots)}{(b_1 + b_2 + \ldots)} \qquad (2)$$

Herein

W = one-half of the load.

a_1, b_1, a_2, b_2, a_3, b_3, etc., dimensions as given in the diagram.

k is the number of equal parts into which the center line A-1-2-3....7 is divided.

x is the "scale factor," i.e., x is dependent on the scale to which the drawing of the bail is made; if, for example, the scale is 2 ÷ 5, then, $x = 5 \div 2$.

(*Note*—The formulas 1 and 2 are readily obtained from the general equation for the horizontal displacement, viz:

$$y = \frac{1}{E \cdot I} \int b \cdot M \cdot ds = 0$$

1st condition

and from the equation for the total change of the angle β_1, viz:

$$\Delta\beta_1 = \frac{1}{E \cdot I} \int M \cdot ds = 0$$

2d condition

in which M is the bending moment at any point along the bail, and ds is the arc-differential; E = modulus of elasticity; I = momentum of inertia of section.)

The bail is assumed symmetrical with reference to the center line AC; then, only one-half of the bail needs to be considered. To employ formulas 1 and 2, the center line A-1-2-3....7 is divided into a number of equal parts; then the distance from the central point of each part to the end of the bail is measured, viz: a_1, b_1, a_2, b_2, a_3, b_3, etc., and the calculation done according to the formulas.

The design is usually made to a certain scale; however, it is not necessary to use the actual dimensions of a and b when measuring same from the drawings. For formula 1 and the following 3, the use of the "scale factor" is not required. In formula 2, on the other hand, the "scale factor" must be considered, as previously explained.

As Q and m are now known, the bending moment at any point along the bail can be found. To ascertain where the maximum bending moment occurs, a graphical method will be found most convenient.

First, however, we shall state a general rule for determining the sign of the moment M; it is as follows:

M is positive when it tends to increase the curvature of the bail, negative if the curvature is decreased.

In our case, therefore, we have:

Moments produced by W are positive, and moments produced by Q are negative. The sign for the constant bending moment m is determined by the formula 2.

The bending moments due to W and Q are proportional to the distances a and b, respectively. We, therefore, calculate the values $W \times l$ and $Q \times h$, select a scale for the bending moments, and lay off $W \times l = CE$ and $Q \times h = BH$ to this scale; then, the straight lines $E7$ and HB_7 are drawn. The bending moments at any point, for example, at point 3, are then given by the distances C_3E_3 (bending moment due to W), and B_3H_3 (bending moment due to Q). We also have to consider the constant bending moment m. In our case the calculation of m from formula 2 will give a positive bending moment; m must, therefore, be added to the moments produced by W.

To combine the moments, we make $m = BD$ and draw the line DD_7 parallel to BB_7; this satisfies the condition that m is constant along the bail. Then, we lay off $DG = CE$, and $D_1G_1 = C_1E_1$, $D_2G_2 = C_2E_2$, etc., and plot the curve $GG_1G_2G_3 \ldots D_7$. All moments within the figure $(BGG_1G_2G_3 \ldots D_7B_7B)$ are positive, and all within the triangle BHB_7B are negative. We, therefore, have the resulting bending moments represented by the differences BG minus BH, B_1G_1 minus B_1H_1, etc., or the resulting moments are the distances HG (+), H_1G_1 (+), H_2G_2 (—), etc. It is of great importance to use the correct sign for the resulting bending moments, as the sign determines the nature of the stress in the bail, whether compressive or tensile. The distances between the lines HB_7 and $GG_1G_2G_3 \ldots D_7$ thus gives a very clear representation of the relative straining of the bail; the maximum distance is determined by direct measurement, and represents the maximum bending moment to the scale selected; it is usually the distance HG, located at the section A.

The Hinged Lifting Bail

The condition for this bail requires a horizontal reaction Q only; this is calculated from the following formula:

$$Q = W \cdot \frac{a_1b_1 + a_2b_2 + \ldots}{b_1^2 + b_2^2 + \ldots} \qquad (3)$$

The same rules with respect to the sign of the bending moments will apply here. In determining the resulting moments, we make use of a part of the former diagram, viz: the curve $GG_1G_2G_3 \ldots D_7$; we

then calculate the moment $Q \times h$, and lay off $Q \times h = DF$, and draw the straight, dotted line FD_7; the triangle (DFD_7D) is then the negative moment diagram. The positive bending moments are within the figure $(DG\,G_1G_2 \ldots D_7D)$, and the resulting moments are the distances FG (+), F_1G_1 (+), F_2G_2 (—), etc. Usually, the maximum distance is FG.

General Case

A more general case is shown in Fig. 3. The same formulas, 1, 2 and 3, will apply here, but care must be taken to use correct signs of a in the formula. As a general rule, we have that a is negative if the bending moment $W \times a$ is negative. The bending moment diagram must be changed correspondingly.

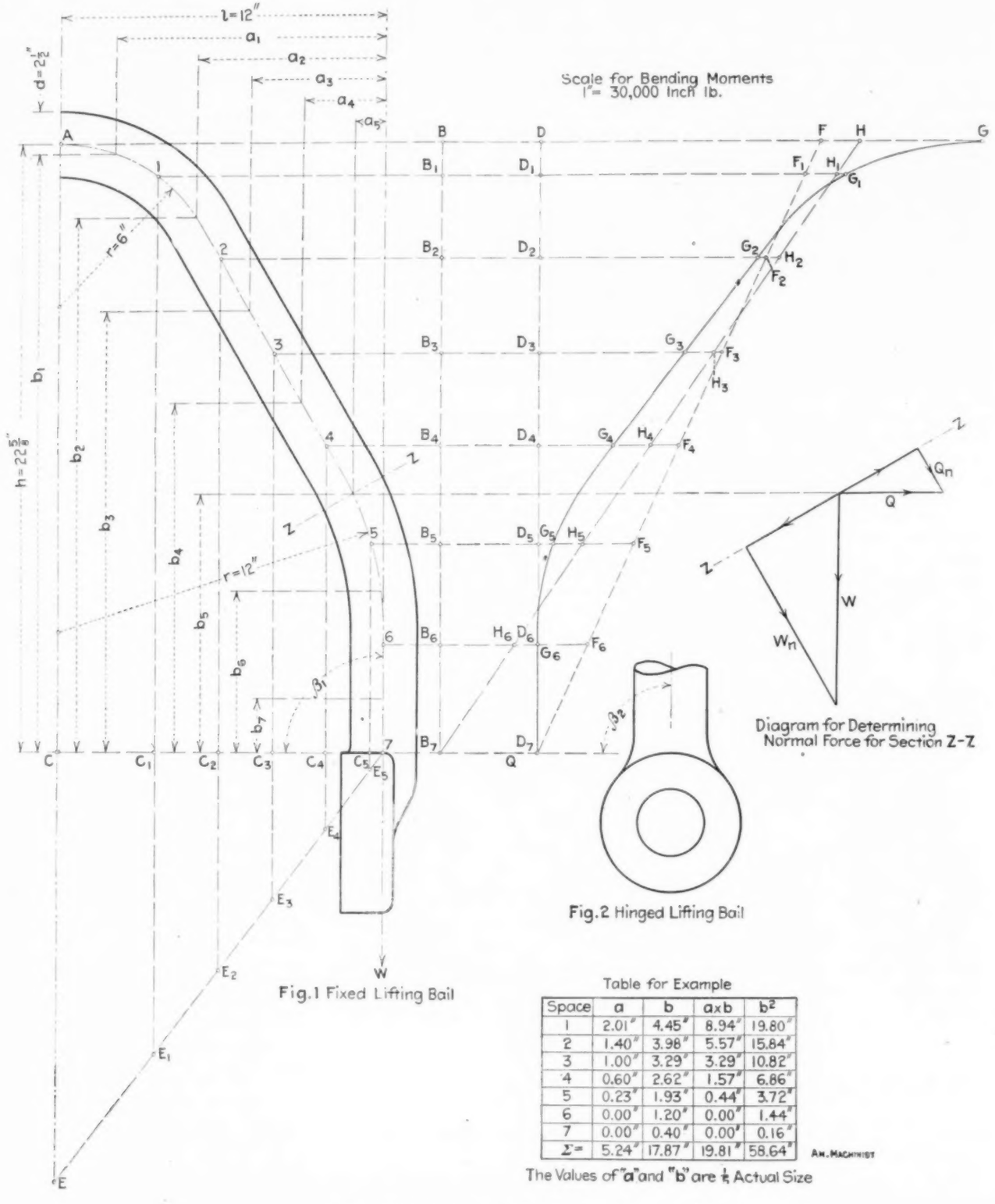


Fig. 1 Fixed Lifting Bail

Diagram for Determining Normal Force for Section Z-Z

Fig. 2 Hinged Lifting Bail

Table for Example

Space	a	b	axb	b²
1	2.01"	4.45"	8.94"	19.80"
2	1.40"	3.98"	5.57"	15.84"
3	1.00"	3.29"	3.29"	10.82"
4	0.60"	2.62"	1.57"	6.86"
5	0.23"	1.93"	0.44"	3.72"
6	0.00"	1.20"	0.00"	1.44"
7	0.00"	0.40"	0.00"	0.16"
Σ=	5.24"	17.87"	19.81"	58.64"

AM. MACHINIST

The Values of "a" and "b" are ½ Actual Size

Calculation of Stresses

The method of determining the stresses is the same for both cases, but different methods must be employed in proportion as the section to be calculated belongs to the straight or curved part of the bail. Calculations of stress for *straight* part is as follows: The *normal* stress, i.e., the stress due to forces acting normal to the section, is determined by

$$s_n = \frac{N}{f} \qquad (4)$$

Herein, N = force in pounds, normal to the section; f = area of section = $\frac{\pi d^2}{4}$ square inches; d = diameter of the bar.

The normal force is obtained by resolving the forces W and Q in components, parallel and normal to the section, as shown graphically for the section zz. The normal components W_n and Q_n act in the same direction and are, therefore, added together; the sum is the normal force N; s_n is to be taken with positive sign. Forces parallel to the section, or shear forces, are neglected.

The *bending* stress is determined at the outside of the bail by

$$s_{b_1} = \frac{10\,M}{d^3} \qquad (5)$$

and at the inside of the bail by

$$s_{b_2} = -\frac{10\,M}{d^3} \qquad (6)$$

Herein, M = bending moment, inch-pounds, for the section in question.

The *combined* stress is then, at the outside of the bail

$$s_1 = s_n + s_{b_1} \qquad (7)$$

and at the inside of the bail

$$s_2 = s_n + s_{b_2} \qquad (8)$$

Care must be taken in introducing the correct signs, whether positive or negative, for s_b in the formulas 7 and 8; i.e., the correct sign for M must be used in calculating s_b from 5 and 6. If the combined stress is positive, the stress is tensile, compressive if it is negative.

Calculation of stress for *curved part* is as follows: The *normal* stress is calculated by formula 4. The *bending* stress is determined at the outside of the bail by

$$s'_{b_1} = \frac{10\,M}{d^3} \cdot p_1 \qquad (9)$$

and at the inside of the bail by

$$s'_{b_2} = -\frac{10\,M}{d^3} \cdot p_2 \qquad (10)$$

s' indicating that the section belongs to the curved part of the bail; p_1 and p_2 are factors, depending on the ratio $d \div 2r$ at the section to be calculated; values are given in Table 1; r is the radius of curvature.

The *combined* stress is then, at the outside of the bail

$$s'_1 = s_n + s'_{b_1} \qquad (11)$$

and at the inside of the bail

$$s'_2 = s_n + s'_{b_2} \qquad (12)$$

$d \div 2r$	0.05	0.10	0.15	0.20	0.25
p_1	0.967	0.930	0.900	0.870	0.840
p_2	1.040	1.080	1.134	1.180	1.235
$d \div 2r$	0.30	0.35	0.40	0.45	0.50
p_1	0.810	0.785	0.760	0.737	0.718
p_2	1.300	1.365	1.444	1.540	1.650

TABLE 1

Examples of Calculation

The diagram shows a lifting bail of 16,000 pounds capacity, hence W = 16,000 ÷ 2 = 8000 pounds. In the table printed with the diagram, all necessary dimensions for calculating are given; the center line of the bail is divided into k = 7 equal parts.

For the *fixed lifting bail*, Fig. 1, we have from formula 1,

$$Q = 8000 \times \frac{7 \times 19.81 - 5.24 \times 17.87}{7 \times 58.64 - 17.87^2}$$

$$Q = 3975 \text{ pounds}$$

and from formula 2, considering that the drawing is made to the scale 1 ÷ 5, whence x = 5

$$m = 5 \times \frac{3975 \times 58.64 - 8000 \times 19.81}{17.87}$$

$$m = 20{,}800 \text{ inch-pounds}$$

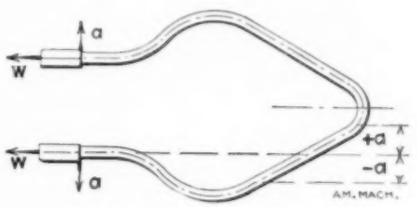


FIG. 3. A GENERAL CASE

Then

$$W \times l = 8000 \times 12 = 96{,}000 \text{ inch-pounds}$$

and

$$Q \times h = 3975 \times 22.625 = 90{,}000 \text{ inch-pounds.}$$

Let 1 in. represent 30,000 inch-pounds, then

20,800 ÷ 30,000 = 0.69 *in.* = m = BD

96,000 ÷ 30,000 = 3.20 *in.* = CE = DG

90,000 ÷ 30,000 = 3 *in.* = BH.

The maximum moment is the distance HG at the section A; it measures 0.89 in., and is positive; hence

$$M = 0.89 \times 30{,}000 = +26{,}700 \text{ inch-pounds}$$

The normal force for section A is

$$N = Q = 3975 \text{ pounds}$$

We then get from 4 and for d = 2.5 in.

$$s_n = \frac{3975}{\frac{\pi}{4} \times 2.5^2} = +810 \text{ lb. per sq.in.}$$

As the section A belongs to the curved part of the bail, we shall use the formulas 9 and 10. Now the ratio $d \div 2r$ = 2.5 ÷ 12 = 0.208, whence from table 1, we get p_1 = 0.865 and p_2 = 1.189. Then from 9

$$s'_{b_1} = \frac{10 \times 26{,}700}{2.5^3} \times 0.865 = +14{,}800 \text{ lb. per sq.in.}$$

and from 10

$$s'_{b_2} = -\frac{10 \times 26{,}700}{2.5^3} \times 1.189 = -20{,}400 \text{ lb. per sq.in.}$$

The combined stress is from formula 11

$$s'_1 = 810 + 14{,}800 = +15{,}610 \text{ lb. per sq.in.}$$

tension, and from 12

$$s'_2 = 810 - 20{,}400 = -19{,}590 \text{ lb. per sq.in.}$$

compression.

At section 7, we have the moment $M = B.D_7 = m = +20{,}800$ *inch-pounds* and the normal force

$$N = W = 8000 \text{ pounds}$$

then

$$s_n = \frac{8000}{\frac{\pi}{4} \times 2.5^2} = 1635 \text{ lb. per sq.in.}$$

At the section 7 the bail is straight; we, therefore, get from formula 5

$$s_{b_1} = \frac{10 \times 20{,}800}{2.5^3} = +13{,}300 \text{ lb. per sq.in.}$$

and from 6

$$s_{b_2} = -\frac{10 \times 20{,}800}{2.5^3} = -13{,}300 \text{ lb. per sq.in.}$$

and have the resulting stresses.

From 7

$$s_1 = 1635 + 13{,}300 = +14{,}935 \text{ lb. per sq.in.}$$

tension

From 8

$$s_2 = 1635 - 13{,}300 = -11{,}665 \text{ lb. per sq.in.}$$

compression

The tensile stress at section 7 is thus almost equal to the tensile stress at point A. For the high grade of iron to be used in the manufacture of lifting bails, a tensile stress of about 16,000 pounds per square inch may be allowed. The compressive stress at section A is usually rather high; practically, however, it is not considered so dangerous, as the load at the place of contact is not concentrated but distributed over an arc, thereby tending to decrease the theoretical compression-stress, which generally should be kept below a limit of 20,000 lb. per square inch.

For the *hinged lifting bail*, Fig. 2, we have, from formula 3

$$Q = 8000 \times \frac{19.81}{58.64} = 2700 \text{ pounds}$$

Then

$$W \times l = 8000 \times 12 = 96{,}000 \text{ inch-pounds}$$

and

$$Q \times h = 27{,}00 \times 22.625 = 61{,}000 \text{ inch-pounds}$$

Let 1 in. represent 30,000 inch-pounds as before, then

96,000 ÷ 30,000 = 3.20 *in.* = CE = DG

and

61,000 ÷ 30,000 = 2.03 *in.* = DF.

At the section *A* we have the maximum bending moment:

$$M = FG = 1.17\ in. = 1.17 \times 30{,}000 = + 35{,}000\ inch\text{-}pounds;$$

then

$$s_n = \frac{2700}{\frac{\pi}{4} \times 2.5^2} = 548\ lb.\ per\ sq.in.$$

As before, we have for $d \div 2r = 0.208$, $p_1 = 0.865$ and $p_2 = 1.189$.

Then

$$s'_{b_1} = \frac{10 \times 35{,}000}{2.5^3} \times 0.865 = + 19{,}400\ lb.\ per\ sq.in.$$

and

$$s'_{b_2} = -\frac{10 \times 35{,}000}{2.5^3} \times 1.189 = - 26{,}600\ lb.\ per\ sq.in.$$

The combined stresses are:

$s'_1 = 548 + 19{,}400 = + 19{,}948$ *lb. per sq.in.* tension stress, and

$s'_2 = 548 - 26{,}600 = - 26{,}052$ *lb. per sq.in.* compression.

These stresses are too high; safe values are obtained by increasing the diameter to 2.75 inches.

As a general and important result of the investigation, we can state, that there is a rather great difference in the distribution and the intensity of the stress for the two cases considered. The fixed lifting bail is the strongest of the two under the same conditions. On account of appearance and to keep the weight of the bail reasonably low, the diameter of the hinged lifting bail is often increased locally at point *A*, where the bail is under a heavy wear. The fixed lifting bail, on the other hand, can usually be made of smaller, constant diameter, with a resulting decrease in the cost of manufacture.

Special Milling Attachment for the Planer

By Frank L. Walter

As beds of very long planers and lathes have to be made in sections to facilitate handling and shipping, it is very necessary that the joints have true surfaces to insure perfect alignment when they are assembled.

The original method of machining the end of a planer bed is shown in Fig. 1. In this case the bed is blocked up, properly braced, and clamped after it is perfectly level and square with the planer platen *A*. On this platen is bolted an upright *B* which carries a regular planer head.

By taking three or four cuts across the surface and then filing and scraping till the end was perfectly square with the V's, it was ready to go to the horizontal boring mill to have the bolt and dowel holes drilled. For this purpose a jig was used. But as this method proved to be too slow and uncertain, the special milling fixture shown in Fig. 2 was designed.

After the bed was planed it was left on the planer without disturbing the clamps or stops. The milling attachment was bolted onto the saddle on the cross-rail of the planer in place of the regular

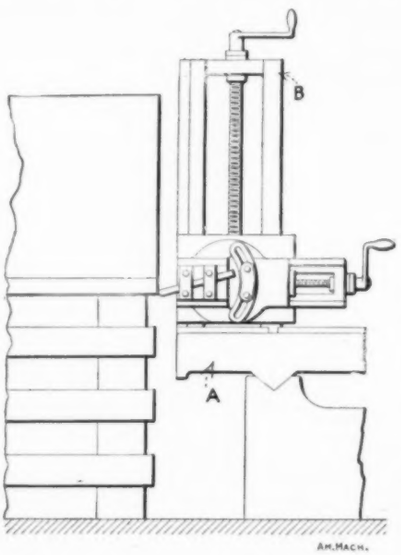


Fig. 1. Machining the End of the Planer Bed

head, using the same four bolts. For feeding the end mill across the work, the large pilot wheel was used, as the screw was half-inch pitch, the ordinary crank furnished with the planer was too small to get a steady feed with.

It required four passes of the cutter to complete the surface, after which a light finishing cut was taken. Then by removing the milling cutter and replacing it by a drill, which was made especially for

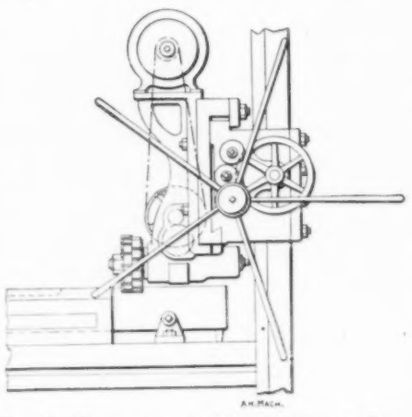


Fig. 3. Milling the Slot Without Disturbing Housing Clamps or Stops

this work and using the same jig, the bolt and dowel holes were drilled.

As the spindle of the milling attachment could not be moved forward like a boring-mill spindle, the work was fed to the drill by pulling the planer belt by hand. After the bed was taken off the planer it was ready to go on the assembling floor without any tinkering.

The construction of the milling attachment was comparatively simple. It consisted of the casting *C*, Fig. 2, on top of which was mounted a two-horsepower motor. The spindle was driven by this motor through a belt on the pulley *D* and the gearing *E* and *F*. On the same shaft that held the gear *F* was a worm that meshed in a worm gear on the spindle.

The spindle had taper bearings which ran in bronze boxes, and had a hole entirely through it for a draw-in rod which

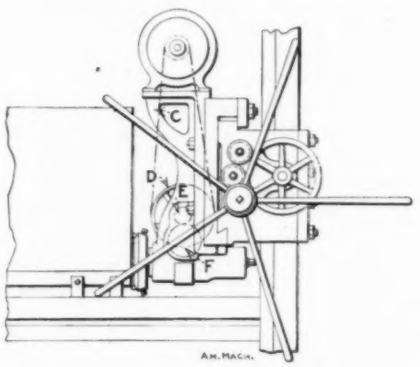


Fig. 2. Specially Designed Milling Fixture

held the mills and drills. This same attachment was also used for milling the slot across the planer housings. In place of these slots there was formerly the tongue, but as it was seen that by removing the tongue from the housings and placing it on the planer beds, the housing seat could be planed in the same setting as the inside strip of the housing, and without disturbing the clamps or stops that held the housing on the planer platen, the slot was milled as shown in Fig. 3.

As this milling attachment saved two settings on the bed and a setting on each housing, it proved to be a good investment besides doing better work.

Scores of aëroplanes, thousands of automobiles, and millions of feet of motion-picture film appear among the articles forming the foreign trade of the United States for the current fiscal year. The number of aëroplanes imported and exported during the fiscal year just coming to an end will aggregate a half-hundred valued at approximately a quarter of a million dollars. The number of automobiles imported and exported will aggregate approximately 20 thousand, valued at about 25 million dollars. The motion-picture films, imported and exported will amount to 75 million feet in length, or sufficient to reach more than half way round the world.

Manufacturing Wax Cylinder Records

By Ethan Viall

An automatic molding machine capable of an output of 7000 records per day.

Method of finishing the inside of the gold-molded record, and the way they are removed from the cylindrical master-mold.

A few years ago the making of the master molds from which the wax-cylinder phonograph records are made at the Edison Phonograph Works, Orange, N. J., was described in detail in the AMERICAN MACHINIST; therefore no attempt will be made to do so here. However, for the benefit of those who did not see that article the process is briefly as follows:

An original, or master record, is produced on a cylinder, made of a special grade of wax, in substantially the same way that records are produced on the Edison business phonograph, or at home, though with a great deal more care. The outside of the wax master with its fine wavy lines is then coated with gold by a special process, invented by Thos. A. Edison. Next this coating of gold is electroplated with about $\frac{1}{16}$ in. of copper, which process takes about four days. This copper shell, with the wax cylinder still in it, is now turned smooth on the outside and fitted into a heavy brass shell, which really forms the body of the mold.

The wax master cylinder is removed from the combination gold-copper-brass shell by putting it in a place considerably colder than the workroom, which causes the wax to shrink and drop out, leaving a strong cylindrical master mold from which thousands of wax records may be made. It will be seen from this that the master wax cylinder is not destroyed and a number of master molds may be made from it.

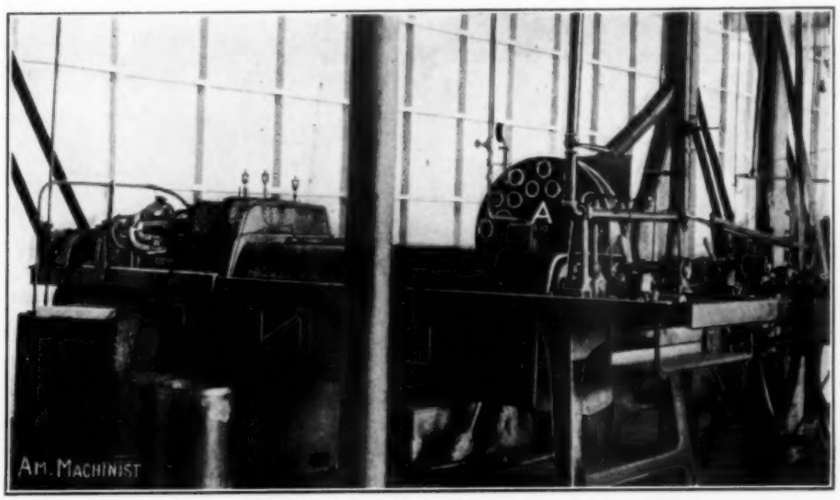


FIG. 1. CYLINDER PHONOGRAPH RECORD-MOLDING MACHINE

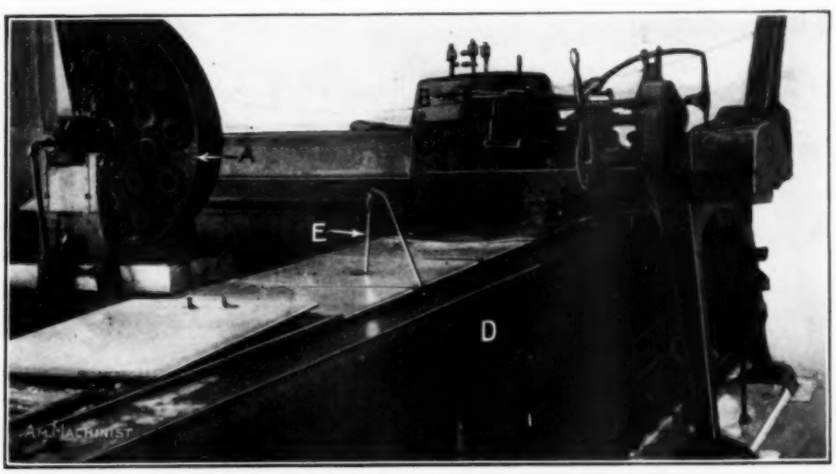


FIG. 2. MOLD HEATER, WAX TANK AND FEEDING CHUTES

THE MOLDING MACHINE

Using master molds, produced as indicated, the commercial records are made in automatic molding machines, each capable of turning out an average of 7000 molded wax-cylinder records a day, and the Edison factory output per day, in the busy season, runs close to 80,000 records.

One of the automatic record-molding machines is shown in Fig. 1, and a view of the same machine, as seen from the opposite side and opposite end, is shown in Fig. 2.

Previous to placing the molds in the machine, they are heated to about 180 deg. in the steam heater shown at *A*, which is done to avoid chilling the wax when it comes in contact with them. Then a boy takes them, two at a time, and places one in each of the chutes, *B* and *C*, whence they roll down into holders over the wax tank and directly in front of three rolls that extend the full length of the machine. As they drop into the holders, a pump squirts a given amount of a special kind of melted wax into each one and then they are automatically shoved onto the top of the long revolving rolls, which spin them at about 1300 r.p.m.

The centrifugal force generated by this spinning whirls the melted wax out against the inner walls of the molds, making an accurate cast of all the tiny waves made by the master record, and also leaves the center of the new record hollow with just enough surplus wax to finish nicely. As additional molds are fed they are gradually worked to the opposite end of the machine, of course spinning all the time and gradually becoming cooler, though still quite hot.

In the halftone, *D* is the wax tank under which are gas burners used to heat the wax to the desired temperature. *E* is a thermometer suspended in the melted mixture. Large melting kettles are used to melt fresh wax and supply the large tanks, so as to not chill the wax from which the records are made. Hoods are used over the melting kettles to carry off the fumes that arise.

GROOVING THE INSIDE

In Fig. 3 the chute along which the master molds are rolled to the steam heater *A*, is shown at *B*. At *C* and *D* two molds are shown dropping from the spinning rolls. From here they are taken by a boy and placed in the chute *E* along which they roll to the turret lathes shown in Fig. 4. When they reach the machines the molds are at once placed in

chucks as shown at *A* and *B*. These are simply hollow cylinders, slightly tapered at the back to hold the molds by friction.

As soon as the mold is in the chuck the toothed tool *C* in the turret, is run in by pulling on the handle *D*, and then the wax record is ribbed inside and cut taper to fit the mandrel on which it is to be placed in use. The cross-slide is worked by the lever *E*, in order to make the tool cut. The tool *C* is ground not only to cut ribs in the wax and taper the inside properly, but is water-jacketed in order to keep the hot wax from heating the knife and sticking to it. The cold water is supplied to the tool through the hose *F* and *G*.

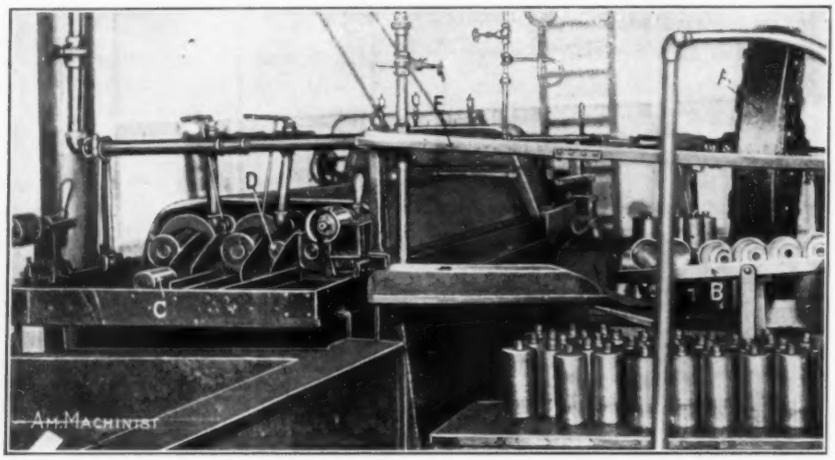


FIG. 3. MOLDS COMING FROM THE MACHINE AND CHUTES USED FOR CONVEYING PURPOSES

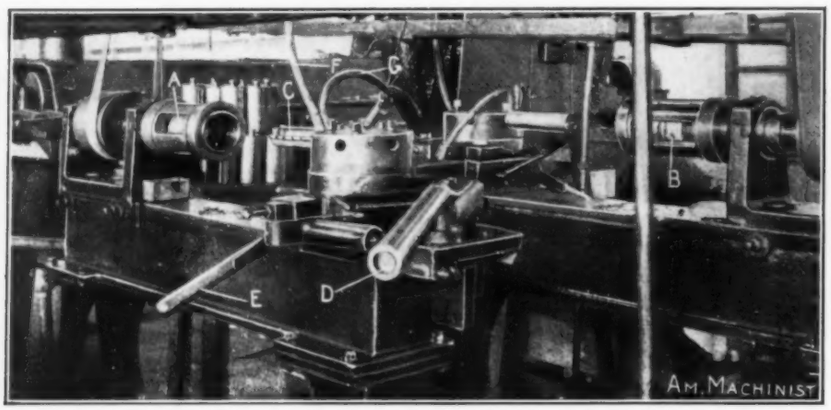


FIG. 4. TURRET LATHES USED FOR FINISHING THE INSIDE OF THE RECORDS

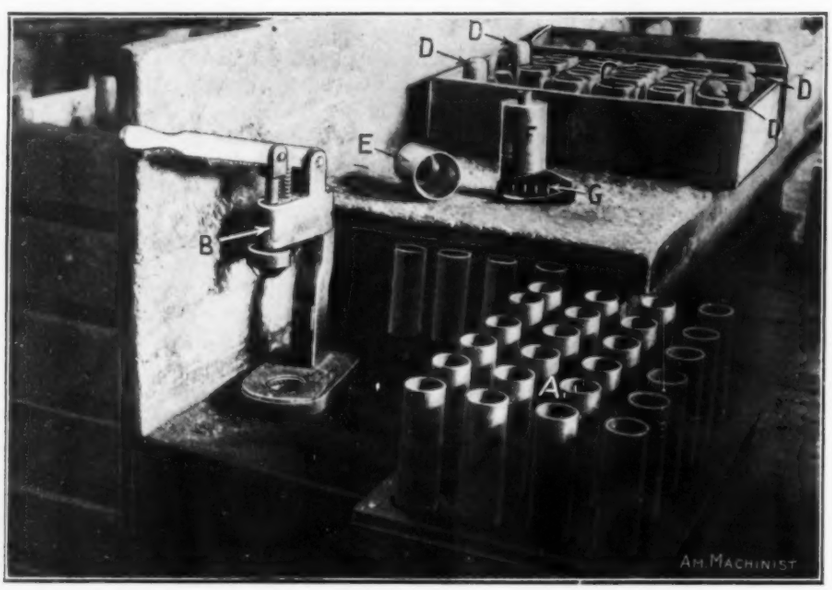


FIG. 6. COOLING MANDRELS, PRESS AND HANDLING TRAY

REMOVING THE WAX CYLINDERS

From the turret lathes the molds are rolled in chutes to the coolers shown at *A* and *B*, Fig. 5. These coolers are cast-iron boxes made so that 18 molds may be pigeonholed in them, and are water-cooled. Leaving the molds in these coolers a short time cools the wax so that it shrinks and is easily taken out of the mold.

As soon as the wax is cool enough to drop out of the molds, the cylinders are placed over mandrels like those shown at *A*, Fig. 6, and allowed to cool to the temperature of the air. The idea of placing the cylinders over the mandrels is to keep them from distorting or warping as they cool.

When the cylinders have cooled sufficiently, the mandrels are pressed out of the cylinders in the small handpress shown at *B*; then they are placed over pegs in trays like *C*, so as to be easily handled. These trays have four long pegs *D* at the corners, so that the trays may be easily stacked without injuring the cylinders. At *E* and *F* are shown two master molds, and at *G* is a piece of a broken, wax-cylinder record, showing the ribs on the inside.

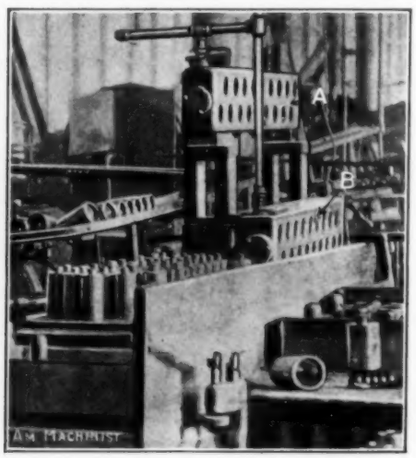


FIG. 5. MOLD COOLERS

The recent failure of a steel standpipe, 140 feet tall and 20 feet in diameter, which had been in service nearly 25 years, has been the cause of some speculation as to what caused the failure. It appears that the structure was designed with a factor of safety of 3, whereas at the present time a factor of safety of at least 5 or 6 would be used. The material was somewhat brittle, and the initial failure apparently occurred by rupture through a line of rivets in the bottom course.—*The Boiler Maker.*

Industrial Education in New England

By E. H. Fish*

A review of the beginnings and growth of publicly supported industrial schools in New England. Less than six per cent. of the eligible boys are now receiving training. Yet the outlook is encouraging, as a number of important points have been demonstrated.

*Manager, Worcester Trade School.

Of all the New England States Massachusetts and Connecticut only have legally provided for industrial education in secondary schools. In Concord, N. H. and Newport, R. I. there is a small number of pupils being trained along industrial lines, but the work is so little different from the customary manual training as to take it out of the scope of this article. Fitchburg, Mass., and Providence, R. I., have part-time schools which are partly private and partly public and though already described in these columns are sufficiently important to demand a brief review here.

The laws of Massachusetts have permitted the local school committees of all cities and towns to establish industrial schools for the teaching of trades for the past 40 years, but the law was a dead letter until 1905, when the Douglas Commission was appointed. This commission, the best known member of which was its chairman, the late Carroll D. Wright, recommended that a commission be appointed to establish schools in coöperation with the local authorities throughout the state, these schools to be independent of the public schools. A bill carrying out these recommendations in the main was made a law Jan. 24, 1906.

	Machine drawing	Machinists (all branches)	Textile work (all branches)	Electricians	Gasoline engine practice	Architectural drawing	Steam engineers	Applied design	Carpenters	Pattern making	Plumbing	Free hand drawing	Shop mathematics	Cabinet work	Forging	Firem'n and janitors	Interior decorating	Auto. body design
Boston	116	89	...	...	...	42	...	11	...	19	18	47	...	...	18	21	20	15
Brockton	37	...	...	...	...	...	...	...	...	...	...	12	...	...	...	...	...	...
Cambridge	98	53	...	...	...	...	...	...	...	21	...	...	...	...	13	...	...	...
Chicopee	36	58	...	...	40	...	...	...	...	5	...	...	...	12	...	...	...	...
Hyde Park	29	...	...	...	...	...	...	19	...	...	...	...	...	...	...	...	...	...
Lawrence	79	...	244	122	...	50	104	34	...	...	...	...	...	...	...	...	...	...
New Bedford	17	21	...	13	11	...	49	31	60	...	52	...	16	...	...	...	...	...
Newton	33	18	...	...	...	51	...	...	...	...	...	...	20	...	...	...	...	...
Taunton	40	...	...	...	...	11	...	53	...	...	...	...	...	...	...	...	...	...
Worcester	40	79	...	78	108	...	...	...	25	25	...	...	17	21	...	...	...	...
	525	318	244	213	159	154	153	148	85	70	70	59	53	33	31	21	20	15

REGISTRATION IN MASSACHUSETTS STATE AIDED EVENING SCHOOLS
OCTOBER, 1911

The terms of this law briefly stated were these: The Governor was authorized to appoint a commission of five persons to serve for three years. This commission was to engage a secretary who should be its executive officer. It was to investigate further into the needs of the state and to initiate and carry on schools wherever it found local communities willing to coöperate. The law also provided that cities and towns desiring industrial schools should provide the schools and their equipment and also one-half the cost of maintenance, but the conduct of the schools and the expenditure of money were to be entrusted entirely to the State Commission.

The commission attacked the problems before it by giving hearings in Boston and in communities where interest appeared, by lectures and by personal investigation of the industries for which children might be trained and of the people who might be benefited by such industrial education. The last field was found the most fertile. Available statistics showed 25,000 children to whom industrial education might appeal, but revealed nothing as to the number who might be expected to take advantage of an opportunity for such training. While statistics showed the numbers employed in various industries they gave little or no indication as to whether anything could be done in schools to aid in the training of children for those industries.

During the summer of 1908 investigations were made in the Massachusetts cities of Lawrence, Lynn, Springfield and Worcester, based on the names of children in the public schools over 12 years of age and below the high schools, with a view to ascertaining the attitude of parents toward industrial education. This canvass became at once an educational campaign and probably had a great influence on the growth of the movement. The canvassers were all interested in the movement and were enthusiastic from a missionary viewpoint. They covered their fields with the intention and result of leaving very few behind who were not converted. In all these cities not over a dozen parents were reported opposed to such schooling, and only about 5 per cent. were indifferent.

In all, some 7000 families were visited and about 4500 children were reported whose parents signified a desire to send them to an industrial school if one were available which taught the desired trade. This investigation included both sexes and about equal enthusiasm was shown by both. Making a 50 per cent. allowance for the parents who said they would send their children to talk with the canvasser, this would indicate that these cities might muster a thousand boys who wished to learn some trade in a school. As a matter of fact, including the Lynn school of the General Electric Co., which is available to these boys but which is not public, there are about 700 boys already pursuing industrial education in those cities, though they have as yet hardly begun their work and have by no means offered any considerable number of the trades which are in demand.

The canvass among manufacturers was conducted along similar lines; 937 establishments were visited. They employed roughly 190,000 workmen of whom 25,000 were under 18 years of age. These employers were of the opinion in general that industrial work should be started in evening schools and that the teaching should be done by men of experience in the trades rather than by teachers from the public schools.

The work of the commission along these lines resulted in the springing up of a number of evening schools, which have since been abandoned or entirely reorganized through the failure of the local communities to bring them up to the standard contemplated by law and set by the commission. These schools were for the most part old organizations which hoped to take advantage of the opportunity for state aid by mostly nominal reorganizations. It is probable that these schools were sincere in their purpose and expected ultimately to give distinctly independent courses, but their work at the start was mostly of the nature of manual training.

The First School at Northampton

The distinction of being the first school established under the Massachusetts law belongs to the Smith Agricultural School and Northampton School of Industries, at Northampton, which was established March 15, 1907.

While this school was established in good faith with the expectation that it would receive state aid, it has been found necessary through a technicality, for the legislature to make a special ap-

propriation for its benefit each year. The school opened with 84 pupils, 54 in mechanic arts and 30 in agriculture and has kept approximately the same number ever since. It maintains no night classes, but offers only full-time courses.

The school was made possible by Oliver Smith's $30,000 gift to the town in 1844. This sum was to be invested for at least 60 years and then devoted to the purchase of a farm and the maintenance of farmers and mechanics. The fund now amounts to over $300,000. No provision was made for the erection of buildings except from the income of the fund, but the City of Northampton has advanced money to build. As might be expected the school has developed its work along lines closely connected with farm work, the "mechanic arts" so far referring mostly to wood work.

After this the thoughts of the commission turned to evening schools for a time; the first one of these was opened in Cambridge Oct. 14, 1907, with 214 men and 418 women pupils. The school used and still uses the equipment of the Rindge School and gives courses in machine and wood work, forging, drawing and shop mathematics.

The New Bedford School

The third school to be established was in New Bedford, where 256 pupils were enrolled Nov. 4, 1907. Evening instruction was offered in house framing, architectural drawing, shop drawing, shop mathematics, electric motors, gas engines, steam engines and machine work. The school from the start has been under a board of trustees appointed by the school committee and mostly from its own number. This keeps the letter of the law, which requires a board independent of the local schools and yet gives practical control of the independent school to the school committee through the similarity of membership.

The Boston and Lawrence Schools

The fourth school was in Boston and began Dec. 23, 1907, with an enrollment of 786. This school differs from most of the others in the large proportion of classroom work offered as compared with the opportunity for shop work. Classes were formed in jig and fixture design, building estimating, interior decorating, sheet metal and ship drafting, machine drawing and life sketching. Pattern making, forging and training for engineers and janitors have been added by making use of the manual-training equipment of the city schools. It was, and is, practically a part of the public-school system as in the case of New Bedford.

The fifth was the Lawrence school which had day and evening classes from the start. The original registration Jan. 20, 1908, was 698 men and boys. It has always had a phenomenally large registration for the size of the city. This may be explained by saying that its director William H. Dooley has a remarkable faculty for finding out what will "take" with mill people. Further, much of this registration consists of men and boys who have no intention of staying through any long course, but want to get a lift from one class of employment to another, just as engineers who wish to advance from third to second class go to short-course schools to get the essentials to enable them to obtain the desired license.

It may be said here that this has become the policy of the present Massachusetts Board of Education. Practically all schools now offer evening courses which are units in themselves and which last only one winter or possibly only a part of one winter, but which to some extent follow one another. Thus in time a pupil may get a very complete training for some line of work. An essential part of this scheme is that the pupil shall be employed by day in a closely allied occupation so that his dexterity is a result of his day work and his development along lines of skill and knowledge may come from his evening school work. In this way Lawrence has done a great deal for men and women who aspired to rise from the loom to positions of responsibility. This school is now an established institution under the control of the public-school authorities.

The Chicopee and Newton Schools

Chicopee opened the sixth school with 108 pupils, all taking evening work. The school uses the high-school manual training building and equipment, which doubtless hinders its full development. Courses are offered in machine and pattern work, cabinet making and drawing. In spite of its equipment handicap this school is in a somewhat closer touch with the industries than those which preceded it, as its training is almost entirely manual rather than bookish.

New Bedford broke the list of evening schools by starting day classes Nov. 23, 1908. Sixty-five pupils were taken in machine and pattern work, cabinet making, carpentry and power plant operating. The day school is under the same control as the evening school previously mentioned. It is organized very much on the lines of a technical school with the requirements cut down to fit the 14-year old boy. It has its own shops and while it does work along commercial lines it makes no effort to place its work on the market. This school was the birthplace of the so called project system of instruction which has been extensively discussed in these columns.

On Feb. 1, 1909, Newton followed with the fourth day school but the eighth in all. It began in a small way with 18 pupils and a strong cast toward manual training. In spite of the dominating factor of a large technical high school in Newton this school has made large progress toward complete independence in methods. It is now operating on a commercial-shop basis, and though somewhat handicapped for equipment, is showing the possibility of doing some really good work.

This comprises all the schools established by the old commission except an agricultural school at Montague which has since been discontinued. The commission had brought nearly to fruition the schools since established in Worcester, Brockton and Beverly, all of which were in operation before its successor, the Massachusetts Board of Education, was fully organized.

The Beverly and Brockton Schools

Beverly started a school July, 1909, under a board of trustees partly from the city government, partly from the school committee and partly from the United Shoe Machinery Co. The company was largely responsible for the existence of the school and holds the scheme in its own power so far as the shop work is concerned. The proposition of the company was to set aside a portion of its shop for the use of the school and assign the necessary shop instructors, pay the boys half piecework rates for work done in a satisfactory manner and pay over any profits from the operation of that part of the shop to the city.

The city furnished the facilities of the high school and the necessary academic teachers, though the men from the shops alternate in going to the school with their pupils, and teaching them drawing and mathematics. It is the only school receiving state aid that has its pupils divided in this way. It differs from the Fitchburg plan in that the boys are pupils in a school rather than employees of a private shop, and in that all the boys are in one shop so that their work is of a similarity sufficient to establish a degree of correlation between their shop and class work.

The Brockton evening school was the tenth and included some 40 men in freehand and mechanical drawing. It is by far the most popular with women and girls and has over 500 of the latter registered.

The Worcester School

Worcester was eleventh on the list, but it was possible to start with a thoroughness that has since enabled it to come closely up to those which began earlier. The Worcester school had its real beginning in a paper read before the American Society of Mechanical Engineers in 1899 by the late M. P. Higgins on the subject of part-time schools for training mechanics. The paper was largely discussed but the matter lay fallow until 1906 when a few individuals encouraged by the report of the Douglas Commission undertook to push the work. In June

1907 the movement had gathered sufficient force and the mayor, appointed a commission to study the proposition.

This commission decided that whatever the city might do in this direction ought to be done thoroughly or not at all. Its members thought that the city ought to buy property, build a suitable building and equip it in the best possible and most lasting manner. The investment necessary would be upward of $100,000. The state law as originally worded, gave the state authorities the privilege of spending all moneys, with only advisory powers on the part of the local community. This was distasteful to the commission and appeal was made to the legislature for a change. An amendment was consequently added whereby any city or town was allowed to establish and maintain independent industrial schools, under an independent board of trustees, the state to reimburse the community to the extent of one-half the cost of maintenance provided the schools were approved by the commission as to "location, courses of study and methods of instruction."

Most of the previously organized schools reorganized under this new proviso, but waiting for it to be enacted caused a serious delay to the Worcester school. It was, however, opened Feb. 8, 1910, with 52 boys divided equally between wood and machine work.

Five More Schools

During this same year and after the state board was fully organized five additions were made to the list as follows:

On Sept. 1, 1910, Sommerville opened a day school with 44 boys divided between wood and machine work.

The Boston School of Printing and Bookbinding was reorganized to take advantage of the state law and opened its fall term as a state-aided school. It was the first school to attack a closely related group of trades. It has since been temporarily discontinued, but will doubtless soon be running again as a part of the Brimmer School.

Hyde Park (now a part of Boston) opened an evening school Oct. 7, 1910, on very much the same basis as that in Boston and with the same limited application to the actual practice of trades.

Worcester's evening classes were opened Oct. 10, 1910, with 237 pupils all engaged in the practice of trades in the school shop and on the unit system described under Lawrence.

Newton also opened its evening school for the first time Oct. 15, 1910. It offered classroom work, only, at first and began with 117 men. The foregoing schools were all dominated more or less by the spirit of the old Commission on Industrial Education. By July 1, 1909, this commission had thrown up its hands and disappeared, its place being taken by a reorganized Board of Education, appointed by the governor.

The board has taken up the work where it was left by the commission and carried it along the same general lines. The general principles, such as the commercial school shop, the correlation of study and work, the lengthening of school hours, the long course and independence of the public-school system so far as the actual personnel of the schools is concerned all remain the same as before. They have practically had forced upon them the placing of the schools under the direct control of the local school committees, and they have adopted a scheme for methods of instruction referred to above as the project plan, which they offer as one of the methods which will be approved by them.

Since the establishment of the schools above mentioned the following have been put into operation, but have not been formally approved:

The Later Schools

Lowell opened classes which are practically the same as those described under the head of Lawrence. Work was begun in September, 1911, by day classes and in October of the same year in evening classes. The day registration (boys only) was 110 and the evening 527. The school is much handicapped for equipment but appears to be in a fair way to accomplish great results when it is better provided in that respect.

Westfield has opened a day school for machinists only, with a registration of 40. It is hardly sufficiently developed as yet to warrant any description except to say that it is organized on the commercial-shop plan.

Springfield has reorganized its vocational school to come under the wing of the state board. It is really in the third year of its history though it has not been accepted officially as a state-aided school. It has 80 pupils, half wood and half iron workers. It has an excellent equipment of woodworking machinery but a rather limited machine-shop equipment, though it is improving in that respect rapidly.

Holyoke has also established evening classes, though not on a large scale, using the equipment of the day manual-training school.

Boston is just equipping the Brimmer School as a trade school for boys, in wood and machine work, with classes also in tinsmithing. This is an old rearranged school building. It is being equipped with new and good machinery, everything being from makers of high standing, but the shop atmosphere will necessarily be lacking because of the necessary alterations.

There are some other schools in prospect, as for example at Quincy where it is hoped to make some arrangement, similar to that in force at Beverly, with the aid of the Fore River Ship Building Co.

Connecticut Schools

Connecticut has always kept closely on the heels of Massachusetts in educational matters. Early in 1909 a bill was passed by the legislature directing the Board of Education of that state to establish two schools "For instruction in the arts and practices of the trades." It placed $50,000 per year at the disposal of the board for this purpose and provided for the boards' entire control of the schools. It also allowed the board to enter into any agreement that it saw fit with manufacturers for part-time schooling. The law likewise allowed any city or town to contribute toward the enlargement of a school within its borders but gave it no voice in the methods of the school and no control over its management.

It is interesting to notice the different influence in the two states of the failure of the original Massachusetts law. Connecticut placed entire ownership and control in the State Board of Education; Massachusetts placed the initiative in the hands of the local communities and yet gave the State Board of Education such powers of approval that the net result is an equal partnership in the maintenance of schools, the ownership of which is entirely vested in the local communities. The result of this in one instance was that one city with an investment of $175,000 had only received from the state $7700 and yet was allowing the state board fully equal powers of control with itself.

Another difficulty which is becoming a real one in Massachusetts is entirely avoided by the Connecticut plan and that is the out-of-town pupil. In Massachusetts a boy or girl who lives in any community where there is no trade school offering the training which he or she desires, may on approval of the Board of Education attend the nearest school offering that training, and the town is obliged to pay tuition to the city having the school at a rate set by the Board of Education. The state in turn agrees to reimburse the town for one-half the money actually paid out in this way. A small town near a city having a trade school finds itself severely burdened to pay even this net cost of tuition because of the number of pupils who wish to get this trade training. This is all the more galling because of the certainty that these pupils will go to the city to work after completing their course, if indeed they do not go there to live.

When we consider the case of Boston which has not yet annexed all of its "bedroom" towns, it is perfectly natural that the unannexed towns should resent this additional burden. The law is un-

questionably right in saying that these schools should be free to all children in the state but the method adopted works many hardships. Under the Connecticut law the cost of this training for all pupils is distributed over the whole state, and no friction arises beyond that which necessarily appears in any scheme where annual legislation is necessary to provide funds.

In Connecticut a number of towns bid, in a way, for the schools. Bridgeport and New Britain were the winners, public spirited men in each place offering the use of buildings and also equipment to the value of about $8000 each. The New Britain school was opened on June 20, 1910, with classes for machinists and carpenters and by Nov. 1 of that year there were 30 machinists and 14 woodworkers enrolled. The Bridgeport school opened Aug. 15 of the same year with 32 machinists, 20 carpenters, 10 printers, 6 plumbers and 6 draftsmen. This school has evening classes with 80 pupils engaged in active works in machine work, carpentry and printing.

Control of Industrial Schools

In the beginnings of industrial education in Massachusetts there was a most decided stand for entire independence of the public-school system. There had been a law on the statute books since 1872 giving school committees the right to establish trade schools. No advantage had been taken of this law in 35 years, and no amount of pressure appeared to have any results, consequently it appeared necessary to create an entirely separate body to organize the new work. This independence has gradually grown more and more imaginary as the public-school authorities have become convinced that public sentiment was firmly fixed in favor of trade education. Under the first law no local school committee could establish a trade school and receive state aid therefor. This was practically made a dead letter, by making the school committee the appointing power, and by appointing its own members, who met at different times, to transact business for the industrial schools and the public schools. The most recent modification of the law expressly grants the right to establish "independent schools" to the school committees, though still giving the various communities the privilege of establishing such schools under an entirely separate board of trustees.

Worcester is the only city remaining with a separate board of trustees, and by a curious irony of circumstances it is the only city which does not incorporate the word "independent" into the names of its schools. For some reason or other there has appeared to be a fear of direful consequences if these schools are called "trade" schools. It may be said that the Worcester Trade School, either boys' or girls' has never found anything but good to follow from frankly putting its position on the subject of teaching trades before the public in the school name and in every other way.

In Connecticut the two schools are under the same Board of Education as the public schools but they are under separate heads responsible directly to the state board so that their position is one of slightly more independence than those of Massachusetts.

So far as direct administration of these schools s concerned the large majority are under men whose personal acquaintance with the trades which are taught in them is very casual. There are only three under technical graduates and none under men whose training has been wholly shop.

Instructors

Instructors have largely been recruited from the shops. One of the requirements of the Massachusetts board for a trade teacher is that he shall have had five years practical experience at the trade which he is to teach. The result of this combination of college and shop men is something which it will be interesting to watch as time goes on. As it is now the college men on top are largely at the mercy of the shop men below them, and yet they are making demands upon the shop men which the latter find it hard to fill with a clear conscience. This shows itself in a regrettable lack of thoroughness in the work of the shops of many schools. Work is accepted from boys which is a great deal poorer than they are fully capable of doing, and boys are not kept at one thing long enough to be able to do it habitually well, which also appears wrong to a shop man.

Housing

The schools at Northampton and the boys' school at Worcester are the only ones that have buildings designed primarily for their occupancy as trade schools, consequently it cannot be said that there is any established trade-school architecture. The Northampton school is primarily an agricultural school, though it has found its course in "Mechanic Arts" a most popular one. The school buildings are really four in number but they are grouped around a covered court or "arena" in such a way as to make them, in effect, one large building.

The front building, 36x56 ft. is devoted to offices, recitations and drawing, the two side wings each 33x70 ft. are devoted respectively to boys' and girls' work, the boys' work being so far confined to wood working. The rear building, of the same size as the front one, is arranged as an auditorium. The four buildings, with a little additional wall, inclose an area 62x132 ft. which is used as an arena for showing and training animals and the erection of buildings by the wood workers, etc., which require much space but which can proceed better if inclosed. The plans of the Worcester school have already been published in these columns

Equipment

There has been little tendency for these schools to equip on a manual-training basis. It appears to be admitted by all that larger, heavier and more highly specialized machinery is essential. The expense of machine tools has, however, been greater than it has been necessary for school committees to face in the past. The result has been the purchase of much second-hand equipment, which on the whole has been rather antiquated, both as to design and wear. This has been repaired only enough to run and is being used in that condition.

To justify this course the plea has been entered that beginners should not be entrusted with new machinery. On the other hand it has been the experience of those who have installed new machinery that the boys have treated it with greater care and respect than the old, and that the men in the evening classes give the machinery much harder service than the boys themselves.

Wood-shop equipment in general is much better than machine-shop. This is due to the fact that much missionary work has been done by some of the manufacturers of the higher-priced goods, and school committees which have dealt with manual-training schools expect to pay good prices for such machinery, in fact they appear to be spending considerable money that might better be diverted to their machine shops.

In machine-shop equipment there is a notable tendency to limit the largest lathe to one of about 18-in. swing, the planers to 24-in., and the millers to a No. 1½. Very few turret lathes of any kind are to be found, no automatic screw machines, hardly more than one or two gear cutters, grinders are mostly missing, radial drills are entirely absent. In woodworking shops there is little in the way of special labor-saving machines. There are hardly any mortisers or tenoners, irregular molders or four-side molders to be seen. It would seem that if these shops are to train their boys to go into commercial shops they will be obliged to have all these and some other machines so that their graduates may have a working acquaintance with them.

Methods of Instruction

The methods of instruction in all these schools are based on the commercial shop with correlated training in mathematics, science and English. Some of the supposedly commercial-shop work would hardly be recognized as such by those who are associated with commercial shops, and some of the correlated

study appears to be rather far-fetched. All of the schools have some non-correlated study which is of a more or less cultural nature.

It is probably both necessary and desirable that there should be more or less of the latter since pupils' parents demand that there shall be some show of what is known and worshiped as "education" and which is recognized by its association with books. It is also desirable that the graduates of these schools should be something more than mechanics. They should be capable of becoming, with the aid of their school experience, broad-minded citizens, able to take their share in governing themselves outside the shop as well as in it. The correlated study in most of the schools takes the form of classroom work in which the problems are based largely on the past experiences of the pupil in the shop, or at home.

A few schools are making a struggle for the ideal form of education, which consists in making their mathematics, science and English each day relate directly to that day's work in the shop. This necessitates one of two things: Either that the shop work shall be such that all pupils are working on the same job at the same time, or else that the schools shall employ as teachers men of such universal genius that they may be able to understand the shop work and all the mathematics, science and Englisn related thereto. None of the schools has the equipment necessary to comply with the first condition, and none of them is overmanned with men of the latter caliber.

The instructors in these schools average less than $1200 per year, and they are for the most part shop men who have had no school training above the grammar schools. It is unreasonable to demand of such men that they shall keep up with the shop work of a class of boys, all working on an individual basis, and also prepare lessons for classroom use, also on an individual basis which shall relate to the day's work, to say nothing of the impossibility of any school shop offering work to the pupils which will bring out correlated study covering the things with which it is reasonably to be expected a mechanic should be conversant.

The actual shop work is on the average much below the quality that the boys are capable of if they are held closely accountable for results. Part of this is due to the lack of modern machinery, and part to a feeling that it is impossible to have good work done by boys. This latter proposition has been and is daily being disproved at Worcester. The schools at Beverly, Bridgeport, New Britain and Worcester dispose of their product as any jobbing shop would except that Beverly's product is all taken by the United Shoe Machinery Co. The rest of the schools avoid the issue by confining their efforts to the building of equipment for their own use, or for other city departments.

The four schools that sell find a great source of satisfaction in the incentive presented to the boys by the necessity of meeting commercial conditions. The fear of criticism from manufacturers or workers on the score of taking work away from them has so far not proved well grounded. No school has yet produced more than a small part as much as its own instructors would have produced if they had remained in the industries. Until one does there is no chance for criticism.

Enrollment

In Massachusetts and Connecticut there were 15 state-aided or supported schools in full swing Oct. 1, 1911. These schools had 766 full-time day pupils (counting boys only). Of this number there were: 325 machinists; 110 electrical workers; 83 pattern makers; 64 carpenters; 54 cabinet makers; 54 draftsmen; 20 farmers; 19 printers; 14 textile workers; 14 steam engineers; 8 plumbers and 3 architectural draftsmen.

This is, of course, the merest drop in the bucket. As shown there are at least 25,000 boys and girls in the industries of an age eligible to these schools. If half are boys then only about 6 per cent. is being taken care of at present, and there is no way of actually determining how many of the pupils of these schools would have continued in high schools if they had not had this opportunity. The actual percentage of possible good that these schools might do is likely much less than 6 per cent.

Every school is offering the machinists' trade and with the single exception of Lawrence that is the best patronized trade. This is likely to continue, for there are probably more machinists employed in New England than men of any one other trade, unless it be agriculture. This fact in itself will tend to check the movement, for the machinists trade is one of the most expensive to teach as well as to equip.

Electrical workers constitute one of the poorer paid groups and one that is not in great demand in any of the cities where it is being taught most, and yet the schools have more electrical students than of any group except machinists. The lure of the mysteries of electricity and the popular fallacy that there is a mint of money for everybody that knows anything of the science is probably responsible for this condition.

The building trades probably rank next after machine work and farming as the great employing trades of New England, but there we find only 64 carpenters and 8 plumbers, no bricklayers, no plasterers, no painters, tinsmiths nor any other of the building trades. All these are easy to equip, and are cheaply housed. Pattern makers, cabinet makers and draftsmen, the three "clean" trades, draw a total of 191 pupils, which tends to show that some boys are picking for the soft spots. Textile workers are low down in the list, but it will be noted later that they make a different showing in the evening schools. Probably before long as many more trades will be offered by these or other schools.

Sessions

Most of the schools follow the public schools as to length of term, which is usually 40 weeks in the year. The week is usually five days only and the average daily session is about 7 hours. Beverly, Bridgeport, New Britain and Worcester run 48 weeks per year, and Newton 44.

Payment of Pupils

All the schools described are organized purely as public schools and pay no wages to pupils except at Beverly, where the shop work is really private, and is paid for by the United Shoe Machinery Co. at half the regular piecerate for the same work done in its shops. This company has, so far, not made any profit on student work, nor does it appear likely that it will unless allowed to exploit pupils at the expense of their education. Under such circumstances it is easy to see that shorter terms and hours are probably necessary than would be followed in private shops where wages are paid, in order to avoid criticism. It is difficult as it is to persuade parents that their boys are not being exploited by being kept on one job too long.

Again the Massachusetts law clearly provides and the Connecticut law evidently contemplates the admission of 14-year old boys to these schools. Such boys clearly will not be sufficiently mature to be given journeyman jobs even if they stay for four years, or by concentrating are put through a course in less time, therefore, for their good, it is wiser to spread the work out more and not force them to greater attendance.

As it is, the average industrial school demands nearly twice the attendance in a year that is called for by public high schools. To popularie these schools sufficiently so that they will appeal to the pupils who most need them it will probably be necessary to make the hours conform more nearly to the public-school system and then to credit the pupils with any extra time which they may put in during vacations, etc.

Part-time Schools

Part-time schools may be divided for convenience into three groups: Half-time schools, where the public school accepts no responsibility for the pupils' shop work; continuation schools, where only one day or less per week is spent in school and the only attempt is to supple-

ment the pupil's occupation by giving him allied work in the classroom or school shop; and evening schools, where the same thing is done in the evening rather than in the day time.

There is always a question raised as to the classification of the Beverly school, but the authorities there claim to have ample control over the work which the pupils do in the shop, even though it be a private one.

Two strictly half-time schools are in existence in New England but neither comes under the jurisdiction of the boards of education. One is in Fitchburg, the other in Providence. Both are arrangements between the public schools and certain local shops. These arrangements are such that the shops hire their boys in pairs and send one of each pair to the public schools alternate weeks for instruction in the technical studies relating to their trades, and also to obtain some part of the cultural work of the high schools. It should be borne in mind that it is really the shops which send the pupils to the school, not the school to the shops, so that the pupil is really a shop boy rather than a school boy so far as first allegiance goes.

The pupils have a very considerable advantage in that they are paid good wages (for boys) in the shops during their shop week, and they have the disadvantage that their shop work is no different from that of the old apprenticeship except that it is cut in half. The shop foreman is no more a teacher than he ever was. His main interest still lies in getting out the work rather than in training the boy.

Fitchburg is a city of some 38,000 inhabitants, is largely a metal manufacturing city, with a band of noncompeting manufacturers all united in a desire to boom Fitchburg. It has made large capital of the Fitchburg plan of industrial education, and the very fact that the name of the place has been put at stake has undoubtedly helped to impel these manufacturers to make the plan work. Fitchburg has graduated 20 boys from its school and has 100 enrolled, of which number nearly half are still in their first year of high school, and have had no contact with the shop. The 20 graduates have been well placed by the shops from which they graduated, and are well liked by them, as is natural.

Providence is following almost exactly on the lines of Fitchburg, but has not yet progressed sufficiently to permit any conclusion as to the efficacy of this method in a large city where the interests of the manufacturers are less closely knit together. A similar school was proposed in Worcester by the school committee and the local Metal Trades Association but it fell through, only a very few boys applying.

The experience in Worcester and interviews with some of the interested boys and their parents seemed to indicate that the half-time plan can be made to work only by the agreement of the manufacturers not to take boys in any other way. It appeared that boys did not wish to give up their pay for alternate weeks for the sake of the very schooling that they were anxious to get away from in the public schools.

Continuation Schools

Continuation schools are being conducted in Bridgeport and Worcester in connection with the trade schools in those places. Bridgeport has: 24 machinists; 19 tool makers; 1 machine operator; 4 pattern makers; 1 draftsman and 2 from high school, making a total of 51. Worcester has: 44 machinists and 1 patternmaker, a total of 45.

These boys are handled in practically the same way in both places. They attend one-half day per week and their wages are continued by their employers while in attendance at the school. Instruction is given in mathematics, science, and English. The classes are so varied in makeup in both places as to make the problem become one of practically individual instruction. In Worcester half the boys are in the school shops and the other half is divided about equally in two classes, so that no instructor has over a dozen pupils at any one time.

Evening Schools

Evening schools have by far the largest attendance in Massachusetts. The annexed table shows the registration in the state-aided schools at their opening in October, 1911. The general plan of these schools is that of a system of distinct and yet related units. For example, rather than offer a long course in the machinists' trade with its correlated study, it has been found best to cut up the trade into such units as: Drill-press work; elementary lathe work; advanced lathe work; milling-machine work; gear cutting; grinding; planing; scraping; advanced tool making and shop mathematics.

Each one of these may take an entire winter season except for the brightest men. It should be said that the Massachusetts law is so framed that only men already engaged in an occupation at least similar to that being taught can be admitted. In this way a man who is a laborer in a machine shop can be allowed to take up drilling. If as a result of his training he secures a chance to work on a drilling machine he may be allowed to take up lathe or milling-machine work. If then he gets a job on a lathe or miller he can go to advanced work in either of these branches or any of the other things outlined above. Textile work and other industries are handled in the same way. Many of the courses are carried on in the classroom, and in several places manual-training equipment is accepted as suitable for evening trade classes.

An Encouraging Beginning

Compared with the field which industrial education must ultimately cover the work in these two states is so far almost nothing. Compared with the obsolute zero which prevailed up to about 1907 great gains have been made. Between six and seven thousand men, women and children are receiving benefit to a greater or less degree from industrial education. This number is about ⅓ of 1 per cent. of the population of Massachusetts and only about 1½ per cent. of the school population. The investment in land, buildings and equipment has reached $425,000.

No complete statistics are available for the cost per pupil per year. These costs are of course very high in the formative stage of any school, and yet even now the indications are that the cost has fallen as low as $140 per pupil per year in the Massachusetts day schools and to about $18 for evening pupils. This means that after the state aid is received by the schools their net costs to their own communities are half these figure. The average cost per pupil in high schools in the cities of the state is about $65 to $70, so that the net cost of these schools compares very well even now with that of other secondary schools.

Probably the growth of the movement has been fully as rapid as has been good for the communities supporting it. It has been necessary to break into virgin ground as much in getting the right teachers and equipment as in getting the support of the public. It has necessarily been a slow process of elimination, and the wonder is that there is as much agreement among these schools as there is. It may be interesting to sum up the things upon which it has been possible to agree or to nearly agree, as for example:

That there is a real demand for industrial education as is evidenced by the willingness of communities to be taxed for its support, and the avidity with which pupils attend schools when the opportunity is offered.

That commercial work can be done in a publicly supported school shop, and that the work can be marketed without great difficulty.

That it is possible to find instructors in the industries who can and will adapt themselves to the work of teaching both trade and technical branches with fair promptness.

That the day schools draw their pupils from the great middle class of citizens and that the strictly Yankee boy is present in large numbers.

That the full-time day school cannot hope to attract many of the boys who most need this training unless some way can be found for them to earn some

small wage either in or out of the school.

That half-time education, where the shop work is done under private auspices, is lacking in continuity of purpose and correlation of shop and school and is, therefore, not likely to give its graduate the power to rise that belongs to the graduate of a corporation apprentice school or a public full-time school.

That continuation schools are likely to be of great value to a large number of boys who cannot afford to attend any other form of industrial school, and that they may very likely be of great value to those who have passed the age when they might attend a day school.

In conclusion it should be said that industrial education is settling down as rapidly as is well. The time has gone by for anyone to claim that it is a panacea for all social and economic ills. On the other hand the time has gone by for any considerable opposition from old-line school authorities. Details of administration, methods of instruction, etc., will always remain open to improvement, but the general idea of industrial education through the medium of the commercial school shop is undoubtedly extremely well rooted.

The problem of making this training available for the boy who cannot afford to sacrifice any part of his present income, no matter how great the future reward, has not yet been solved. The problem of the young man who does not wake up to the fact that there is no royal road to learning until it is too late, has yet to be solved, and the problem of paying wages for productive work well done in a public school also remains to be solved. But even if these problems are not solved for many years to come, industrial education is sufficiently well rooted even now to go on in some way for many years to come.

Commutator Troubles Reduced by Slotting

By C. A. Tupper

Some of the larger machine shops of the country, as well as other users of electrically driven machinery, recently commenced to follow a practice inaugurated by the motive-power departments of traction companies, viz., the slotting of commutators of the motors used in driving their machines.

This is done by means of a fine cutter, of special shape, which removes part of the mica insulation between each two of the copper segments. It should be so fashioned as to cut each filling of mica down to a depth of about $\frac{1}{32}$ to $\frac{3}{32}$ in. below the surface of the copper, throughout the length of the commutator, and at the same time leave about 0.005 in. thickness of mica on each side of the V-shaped slot.

During this process the armature rests with one end of its shaft in a crotch-shaped support on, say, a wooden horse, and the other in an iron support of the same form clamped to the shaper table. The weight of the armature is ordinarily sufficient to hold the latter in place. A thin V-pointed tool is used.

One shop superintendent says on this point:

It is our practice to slot the mica in every commutator that gives us trouble. We had four 35-hp. motors which, before slotting, were a cause of trouble every day, but now run in a perfectly satisfactory manner. The saving from annoyance, brush renewals and commutator cleaning will, in most cases, far outweigh the expense of slotting.

Referring to another specific case, that of a larger machine, the experience with which led to the present practice, he said:

The commutator had become so badly worn that we decided that it should be trued up by turning on a lathe. But, when this had been done, it was found impossible to keep the commutator clean and the brushes from excessive sparking for longer than three days at a time. After this trouble had kept up for a month or so, we took the armature out again, put it in the best lathe in the shop and had our best machinist turn it down a second time.

I watched the whole performance, to make sure that a first-class smooth surface for the brushes was secured. We then changed the brushes from graphite to carbon and started up again. The behavior of the machine was found to be no better than before. The agent of the company that manufactured it was finally called in. He decided that the disorder was due to the armature being out of correct alignment at the driving end.

My own opinion, on the contrary, was that in turning down the commutator the mica had been left just a little higher than the surface of the copper. Nevertheless, to satisfy the manufacturer's agent, we had the work done that he suggested and made sure that we had the armature in exact alignment.

This, however, did not prove to be the remedy for the sparking, and it was then that the slotting was tried, with the result that the machine commenced running properly and has continued in service without either sparking or blackening of the commutator.

Advantages of Slotting

It was not possible to obtain from ordinary machine shops, except as above cited, any very definite information in relation to the exact results obtained from slotting, as records of work done for the plant's own benefit are seldom kept; but from inquiries sent to a number of men in charge of electric railway repair and maintenance shops the following replies were received.

The results obtained from slotting have been very satisfactory and troubles have unquestionably been materially reduced.

Slotting commutators practically eliminates sparking and increases the life of commutators by permitting the use of a softer carbon brush.

We have slotted commutators that have been in service over two years with practically no indications of wear.

Slotting saves at least one-half the cost of maintenance of commutators and brush carbons.

Fifty per cent. of the trouble on motors overcome.

We have been slotting commutators for about two years and would not think of discontinuing the practice. Are not able to give the results in figures but believe that the saving has been very considerabl.

Flat commutators and flashing have been eliminated.

Slotting is very beneficial to the commutation and lowers operating costs through reduction in the temperature of the armatures (thereby also increasing the motor efficiency.

Other replies are along the same general lines, but only extracts emphasizing definite points have been selected.

A Possible Disadvantage

The only reply unfavorable to the practice is also valuable for suggesting what to avoid. This includes the following:

Slotting commutators is, in my opinion, a makeshift which is a help to an improperly designed motor. It aids commutation but, on the other hand, assists to short-circuit commutator bars, one to another, causing a continuous spark around the commutator and thus resulting in ground to motor frame or commutator shell. Therefore, I do not approve of slotting commutators on properly designed motors.

The difficulty which this correspondent experienced would hardly exist where the precaution is taken of leaving say 0.005 in. of mica at each side of the slot. This, of course, requires a specially shaped tool, such as can now be obtained from concerns making a specialty of equipment for the manufacture and repair of direct-current motors.

Another master mechanic reported the practice as to be recommended "provided a soft, nonlubricated brush is used," and this brings up the point that it is decidedly detrimental to allow oil to be thrown on the commutator from any source, for the slotted out spaces between the copper bars will then act as catch basins, with carbonization of the oil and resulting trouble. This contingency, however, should be prevented by the exercise of ordinary common sense.

Application to a large motor manufacturing company developed the fact that they could give no information as to the slotting of motors used in their own shops, but that customers were requiring it on new machines, and about 70% of the commutators were slotted in the finishing process.

It is, therefore, evident that this process has begun to take a strong hold where direct-current motors are used; and anyone having trouble with the machines in his shop, from the causes referred to, who has not thought of this method of correction, will probably find it worth while considering.

Modern Selling of Machine Tools

By John R. Godfrey

Recommending a rival machine if better suited for the customer's particular needs so as to be sure and have only satisfied customers.

Losing a sale is not the worst calamity that can befall a manufacturer. It frequently pays to let the other fellow have it.

The passing of the old method of charging "all the traffic will bear" and making the price bear some relation to the cost of production.

Occasionally I have mentioned ideas in regard to methods of selling which would have been considered rank heresy a few years ago, but which are winning out in these modern days. The better builders of machinery are getting away from the notion that the only object in life is to make a sale. There are still, however, salesmen who swell up with pride if they succeed in selling a machine, even though they know very well that the customer would have been much better satisfied with a machine built by a competitor.

The machinery dealer is largely responsible for this at the present time, and he seems to be slower than the manufacturer to realize that it is better policy to lose a sale than to have a dissatisfied customer. Nor is this to be wondered at.

I have seen within a week a letter from a large house of machinery dealers to a builder of a certain type of machine tool, containing words to this effect:

If you will allow us the regular discount on your machine, we can place one with the Blank Manufacturing Co. at once. Your machine is better adapted to their work than any other machine made, but unless you give us this discount, we shall put in one of your competitors' machines, as we are not in business for our health.

Leaving ethics out of the question entirely, this is the worst possible method of doing business if one is building for the future. It may answer very well for a fly-by-night concern, but no reputable dealer can afford to do business in that way. For in spite of the many unfortunate features of modern business, every good business man is realizing that no permanent success can be built unless both parties to every transaction receive full value for the money expended. Sooner or later the customer who buys the inferior machine is going to discover that it was not the best for his purpose, and a loss of faith in the judgment or honesty of his dealer will result.

Recommending the Other Fellow's Machine

In contrast to this, I quote from a letter by a well known machine-tool builder, which shows an entirely different attitude and is the secret of the building of a very successful business.

Referring to your inquiry, and our previous correspondence, we have gone into the matter carefully, and regret to advise you that our machine is hardly suitable for the work on account of the long travel to the table which you require. We, therefore, call your attention to the machine made by the White Manufacturing Co., which would be better adapted to this work than ours.

We thank you very much for your inquiry and regret that we cannot serve you in this instance, but our policy is to recommend the machine most suitable for the work, rather than try to make a sale of ours when we know it is not the best machine for the purpose. As you may sometimes be in the market for equipment in our line, we are inclosing a set of circulars of all our machines, and hope we may have the pleasure of serving you in the future.

Can there be any doubt that these circulars will be preserved, and what is more important, that the name of the firm that does business in this manner will be indelibly printed in the minds of the concern making the inquiry? It would be very apt to begin further negotiations with entire confidence in the statements made by such a concern.

Undesirable Customers

That this is not a single instance will be observed in the following quotation from another letter to a concern that complained regarding the inaccuracy of the machine in question.

The machine you have is fully up to standard in accuracy and is as good as it is practical to make it, and we consider that the inaccuracies in the work are in no way due to the machine itself.

We are reminded of a case of a lathe from one of the best makers being rejected because it would not turn a long piece parallel, the piece always being larger in the center than at the ends. The criticism you are making of our boring machine involves the same principle as that in the lathe mentioned. If the machine is not satisfactory to you just as it is, we do not want you to keep it.

Our machines are in use in some of the best shops of the country, and are being used by almost all of the best machine-tool builders, who have from two to six machines, and they consider our machine the best and most accurate machine of its kind made.

We haven't a single dissatisfied customer out of about 700 machines in use and do not wish to have one. We ask that you decide whether you wish to keep the machine or not by Mar. 20, and by the 25th we shall expect either your check for the first payment, or the bill of lading, showing that the machine has been returned to us. If you decide to return the machine, we will reimburse you for the freight charges you have paid.

While this is an entirely different case, it shows how the same spirit pervades this concern also, and the fact that its business is increasing year by year shows that it is no fanciful dream, but the soundest kind of business. When a representative of such a firm calls on anyone in the market for new machinery, he naturally has the entire confidence of the prospective purchaser, and his advice is often asked in regard to equipment, which is entirely out of his own field.

All of this simply goes to show that we have made wonderful strides along business lines within the past ten years. The policy of "doing the other fellow" is not good business, and concerns which adhere to it are bound to be crowded out sooner or later.

The Same Price to All

Then, too, the policy of having a fixed price for a product is equally advantageous to the buyer and the seller. The old idea of the purchasing agent's duty being to force the seller to the lowest possible price is gradually fading into the background. It is probably safe to say that every dollar which a company has saved in this way has been more than offset by loss in quality, time spent in the negotiation, and in other ways.

There are many cases on record where a purchasing agent who has the reputation of driving a particularly hard bargain, has paid more for a machine than his neighbor. Traveling salesmen soon learned to name a high figure in the beginning, so that when they made their last "confidential" discount, the price was at least as high as they would have otherwise secured. In fact I know of one case where the salesman had a special price-list printed, and finally landed the order after a special concession, by which the smart buyer actually paid 10 per cent. more for his purchase than the regular list price.

Whenever a man offers you a special price, you know at once that the price first quoted was only a feeler, and you have no means of knowing that your next-door neighbor is not securing an even lower price than is being quoted you.

I know of one case where a salesman had traveled several hundred miles to see a special customer, who attempted to make him give a discount, and finally put the question to him in this way:

"You have spent considerable time and money coming to see us. You do not want to go away without this order. What

will you do if we refuse to pay you the full list price?

"Leave town by the next train," was the only answer.

He took the order with him, because the buyer was convinced that if he would not cut prices under such conditions that he was securing the machine as cheaply as anyone else.

Modern purchasing agents appreciate the salesmen and the firm they represent who have one price and adhere to it. They realize that their value to their employer does not consist solely in beating down a man's price one-half of one per cent., or in insisting on the prepayment of freight charges.

After the machine has been selected by the man who is to be responsible for the work it produces, the purchasing agent of it becomes a clearing house, through which the order is placed and the delivery of the machine watched from the time it leaves the factory until it reaches the consumer. He can be of vastly more service in preventing delays, in securing the machine as quickly as possible after it is needed, and in various other ways, than by the attempted shaving of prices.

Setting Prices on Machine Tools

This naturally leads to another phase of the question, which has to do with the setting of the price in the first place.

In too many cases the selling price of an article has practically no connection with its cost of production and distribution. One of the reasons given by a large concern for not printing the prices of its machines in its catalog was that they varied according to circumstances.

Further inquiry revealed the fact that the circumstances referred to were principally the way in which the machine was received on the market. If it proved to be popular and a fair demand sprung up, the price was immediately and gradually advanced until it reached the apparent limit at which it could be sold. If, on the other hand, the machine did not move readily, the price was very apt to be reduced as an incentive to buy.

It is very difficult to understand an attitude of this kind, except on the old, and I believe exploded theory, that the charges should be all the traffic would bear. In contrast to this I recall a recent conversation with the head of a very enterprising and prosperous concern in an entirely different part of the country. After introducing improved methods of manufacture into his shop, and keeping a very close account of the cost of each lot of machines, he decided on a very radical and almost unheard-of step.

Improved methods and appliances have resulted in a marked decrease in the cost of manufacture. After keeping careful track of the cost of three separate lots of machines, so as to make sure his figures were accurate, he decided to reduce the selling price of these machines a proportionate amount. This is, of course, almost unheard of, and will probably be called foolishly altruistic by many of his competitors. And yet he believes, and I thoroughly agree with him, that it is simply good business.

This is not being done from any lack of orders, as his business is good, and I am not sure that he will sell any more machines, for the present at least, on account of this reduction of price. He believes, however, that the selling price should bear a definite relation to the cost of manufacture, and is willing to base his profits on this belief.

It does not seem possible that an action of this kind can fail to be advantageous to him in the long run. Customers must respect such a man, and the confidence his conduct engenders is sure to bring its reward in continued prosperity for his concern.

Grinding Five Parallel Bearings

Editorial Correspondence

One of the grinding problems recently put up to the Rivett Lathe Manufacturing Co., Brighton, Mass., is shown in Fig. 1. This is a drop forging, having a total length of 4½ in., the straight portion being 3¾ in. long by $\frac{7}{16}$ in. in diameter, with a shoulder just behind the four prongs.

These prongs are 0.1875 in. in diameter, 0.30 in. long, and 0.53 in. off center, or 1.06 in. from center to center across the axis of the shaft.

The way in which these prongs were ground is shown in Fig. 2. The piece is held in a special chuck *A*, set eccentric to the work spindle and counterbalanced by the weight *C*, which projects behind the special faceplate for holding the chuck. This brings one of the prongs in line with the work spindle, and it is then ground by the small wheel. The diameter of the wheel is limited to ½ in., so as to pass between the adjacent prongs as the work revolves. After one prong is ground the front portion of the chuck *B* is indexed one-quarter way around by means of the lever *D*, and the notches shown in the outer edge of *B*.

This shows one of the many uses to which a small grinder may be put in everyday work, and the way in which it can handle grinding work which would be extremely difficult on power machines. All five bearings must be parallel and in exact alignment.

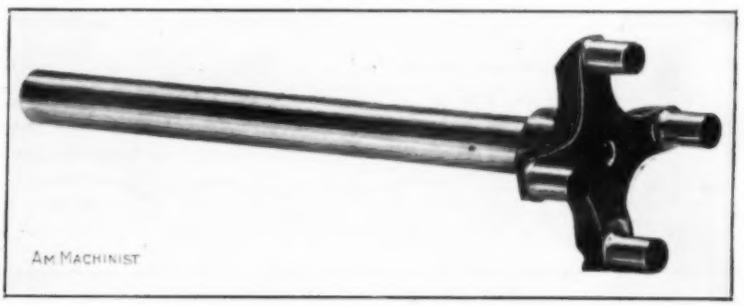


Fig. 1. A Four-prong Piece to be Ground

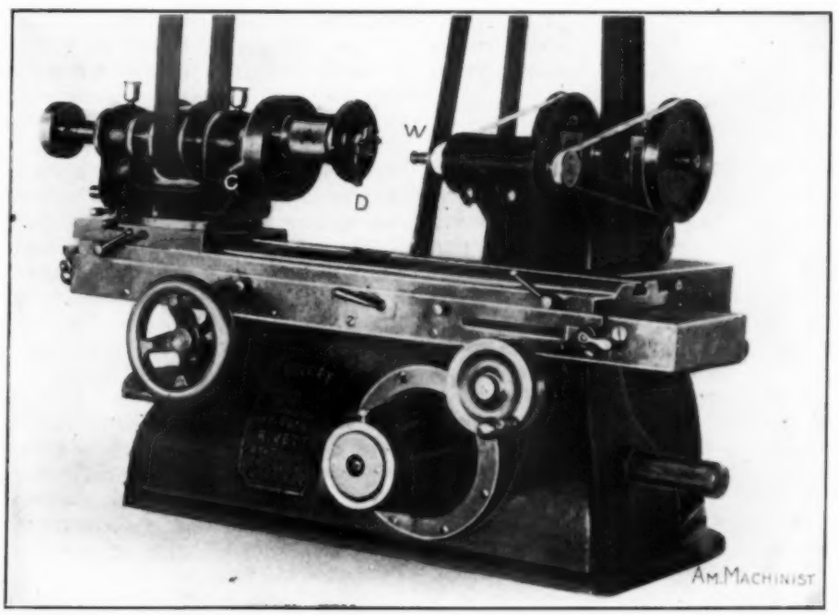


Fig. 2. Grinding the Four Prongs

An Engineering Department's System

By E. M. Wise

One of the greatest problems in the engineering departments of our modern factories is the establishment of an efficient system to furnish the shop with blueprints which are always uptodate, and whereby the proper persons are notified of the various changes which occur, and that will regulate the execution of orders from the chief engineer's office.

An automobile factory has worked out such a system which in use has been found highly satisfactory. The great number of changes made and the thousands of detail blueprints which are in use in this shop require a system which is thorough, reliable and efficient.

The Blueprints

The detail tracings are made up on specially prepared sheets of bond paper, having the title form printed; these are blueprinted on sheets of corresponding size. These prints are arranged in loose-leaf binders and are arranged in numerical order. Each foreman who requires it has a complete set of such prints, which are used principally for reference.

When doing actual work on any piece the foreman notifies the engineering department of the number of the print required. This is printed and mounted on stiff fiber board, so that it can be handled conveniently by the machinist. The foreman is required to sign a receipt for all prints issued to him and a card record is kept, showing the date and department to which the print was issued.

Bills of Material

Bills of material showing the piece number, drawer in which the detail may be found, die or pattern number, number of pieces required, name of the piece, material from which it is made, together with the stock size and length and other information which will be taken up under "changes," are printed on sheets of the same size and material as those used for the details (see Fig. 1). These bills of material have the ruled lines printed on the reverse side so that erasures in the printing may easily be made. When printed, they are bound in loose-leaf books and arranged according to groups, such as, motor, rear axle, transmission and so on.

When it is desired to find the print of a certain detail, the name and group of which are known it is simply necessary to turn to that group in the bill of material book, find the number corresponding to that name and then the blueprint can be found in the numerically arranged blueprint books.

Whenever any changes are made, either on bills of material or details, it is necessary to notify certain parties throughout the factory in order that work on those pieces and the ordering of material can be arranged accordingly. For this purpose a form Fig. 2 has been devised. A record of the change is made on this in black drawing ink and blueprints are sent throughout the factory. These are numbered for filing purposes. If a detail is changed, the change and time it becomes effective are shown on the notice of change.

If the change is on a bill of material, either an addition, one piece superseded by another, cancellation, or change in number required, stock size or length, it is shown on the notice of change and the proper record made on the bill of material itself in the space provided.

When a detail is changed the card record of mounted prints is first referred to and the mounted prints in the factory changed at once, since work is probably being done on the pieces for which mounted prints are out. When these are taken care of, the proper number of loose prints is ordered and all the blueprint books in the factory are brought up to date. When a change on the bill of material is made, the proper number of uptodate prints is ordered and put in the different bill-of-material books throughout the factory.

The tracings, both on the small detail sheets and the large assemblies, are kept in metal drawers of convenient size and are arranged numerically. A blueprint of each tracing is filed along with it and used for reference purposes. When it is desired to take out a tracing or print a requisition must be filled out. This is filed in place of the tracing or print.

Issuing Orders

In issuing the various orders from the chief engineer's office, a three-part form is used. The order is written on the upper part and a duplicate taken on the second. The person receiving the order, signs the upper portion, which is returned to the chief engineer's office and filed. A tickler file is kept and if the answer is not received within a reasonable time the matter is looked into. The answer to the order is written out on the bottom of the blank and returned.

TYPE _____ GROUP _____

PIECE NO.	DWR. NO.	DIE OR PATT. NO.	NO. REQ.	NAME	MATERIAL	STOCK SIZE	LENGTH	SUPERC'D BY	DATE	SUPERC'D'S NO.	DATE ADD.	REMARKS

DRAWER NUMBER _____ DATE _____ THE GARFORD COMPANY ELYRIA, OHIO SHEET NUMBER _____

COMPILED BY _____ CHECKED BY _____

Fig. 1. Bill of Material Form

MR _____ THE GARFORD COMPANY NOTICE OF CHANGE NO.

PLEASE NOTE THE FOLLOWING CHANGES OF TYPE _____ GROUP _____

NUMBER	SUPERSEDED BY	DIE OR PATT. NO.	NO. REQ'D	NAME	MATERIAL	STOCK SIZE	LENGTH	REMARKS

ENGINEERING DEPT.

PER _____

Fig. 2. Notice of Change

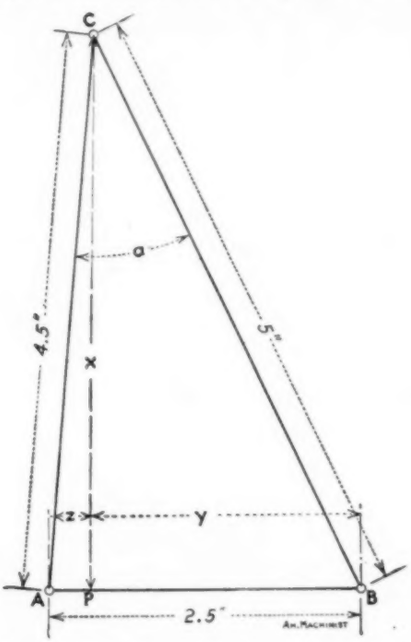
Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Laying Out Holes in Jig Work

Often in jig work one has a hole to be laid out in a relative position to two other holes, as shown in the cut, the angles not being given.

I have found the following method accurate and more direct, particularly if the angle a is small. The two holes A and B being either bored or laid out to the required positions horizontally, the object is to find the perpendicular distance of C from the line AB and also the point P of intersection of the perpendicular on AB. These dimensions can be found without the use of trigonometry by the right-angle-triangle solution. The equations are evidently



LAYING OUT THREE HOLES IN JIG WORK IN RELATIVE POSITION

$$x = \sqrt{5^2 - y^2}$$

and

$$x = \sqrt{4.5^2 - z^2}$$

therefore,

$$\sqrt{5^2 - y^2} = \sqrt{4.5^2 - z^2}$$

simplifying,

$$y^2 - z^2 = 4.75 \qquad (1)$$

But

$$y + z = 2.5 \qquad (2)$$

hence, dividing (1) by (2),

$$y - z = 1.9 \qquad (3)$$

solving (2) and (3) simultaneously

$$y = 2.2$$

and

$$z = 0.3$$

therefore,

$$x = \sqrt{5^2 - 2.2^2} = 4.4.$$

Now, it is evident that when the angle a is small, a slight error along AC or BC will cause considerable change in the correct perpendicular distance x and also in the point P, therefore, if x and y are kept correct, the location of C will be determined accurately.

The axes of direction at right angles being the most direct and accurate method of locating a point by two dimensions, brings the two given dimensions, which are not at right angles, to the right angular position.

THE APPLICABILITY OF THE SOLUTION

This solution can be applied in any case, and if either y or z is greater than the base AB, then the point C will be (horizontally) beyond A or B to the side which has the least or negative value and to the amount equal to the negative value of y or z, as the case may be.

As, for instance, suppose $AB = 2$; $AC = 4.5$; $BC = 5$; then y would be 2.1875, and z would be 0.1875; therefore C would be 0.1875 horizontally distant beyond A.

Of course, if the angles are given, this simplifies the matter, as the sines and cosines can readily be found and applied, but in any case the principle of bringing the measurements to rectangular positions gives accurate results.

Some firms object to the workmen stopping to figure these matters out, but, as a rule, if these dimensions are not given and can readily be figured while the machine is automatically boring the previous hole, time will not be lost in figuring and will be gained by the more positive location and better results than when trying to locate at various angles.

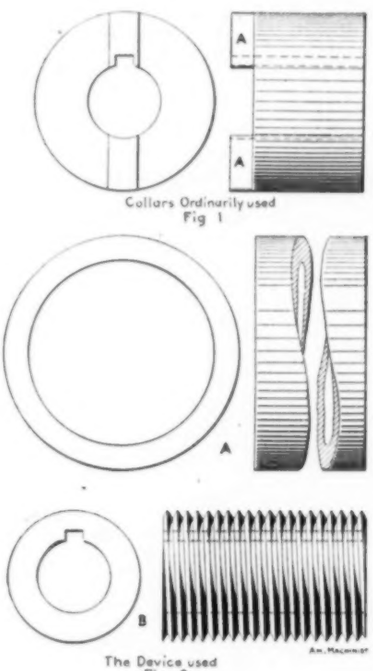
In my practice I have found after boring the third hole and measuring up to the radial dimensions given, that the required dimensions were correct in the first boring operation, where the machine was in good condition.

As previously stated, this method has been found more direct than others often found in use and in addition its extreme accuracy recommends it.

Brooklyn, N. Y. E. D. BOYCE.

Removing Stuck Arbors

Many millers use a collar with two projections instead of a tang, to drive their arbors. Fig. 1 shows the kind of a collar generally used, AA being the projections engaging in a slot milled across the end of the miller spindle. These collars are Woodruff keyed and shrunk on the arbor with about 0.010 in. shrink. Under very heavy cuts the key sometimes shears off and the arbor and cutters stop, but the spindle keeps on revolving. It may revolve for some time before the operator notices it, and hugs the arbor and inside of the spindle so badly that it is a decidedly tough job to get it out. We worked on one the best part of one day, but could not budge it until the foreman suggested the device shown in Fig. 2.



REMOVING STUCK ARBORS

In this the collar A is large enough to slip over the collar on the arbor and long enough to about reach from the spindle to the edge of the collar nearest the cutters. A threaded collar B fits the arbor and is held from turning by a key. If B is threaded standard, then a standard nut can be used to screw over it, otherwise make a nut to fit B, and long enough to get a good hold.

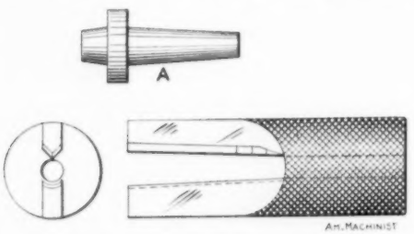
To use this device place the big collar against the spindle or box, slide on the threaded collar against the end of the arbor and place on the nut. Then fill up the arbor with the regular arbor collars and screw up the arbor nut. Screw in the big nut until it is tight against the big collar over the arbor and then with a big wrench, and possibly a sledge, turn the nut until the arbor comes.

Springfield, Mass. F. W. BIXBY.

A Gear Post Taper Gage

The cut shows a taper gage, designed to gage the gear post used in a finishing reel. It is graduated for three lengths. The piece to be gaged is shown at *A*, and is a screw-machine product.

The making of the gage was very simple. A piece of ½-in. drill rod was drilled and reamed with a stock reamer, knurled and cut off; the sharp edges of one side were smoothed off and the opposite side beveled until just a trace of the reamed hole remained. A piece the exact taper was then fitted in, wired and hardened and came out as straight as when it was in the fire. It was then lapped to finish the taper, and the beveled edge stoned sharp. The graduations were etched in after hardening.



A GEAR-POST TAPER GAGE

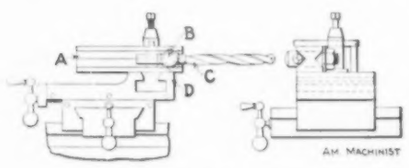
GEORGE G. BUSH.

New Haven, Conn.

Drill Holder for the Tool Post

The line cut shows a lathe tool-holder I made. The height from *A* to *D* is from the top of the rest to the center of the lathe.

In operation set the V of the holder parallel with the lathe bed. When using larger drills than *B* will take, I use a tool maker's clamp for holding the drill in the V. After drilling a boring and facing tool may be used.



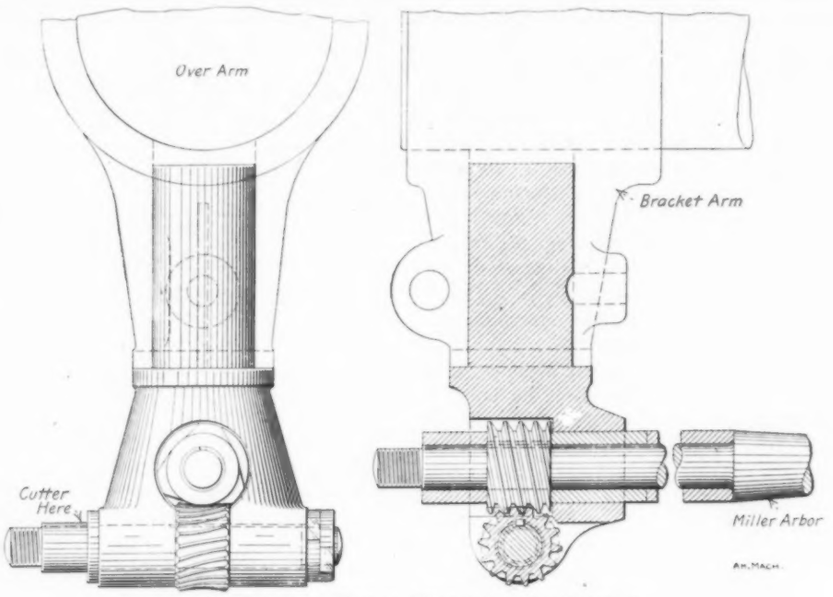
DRILL HOLDER

Kent, England. H. R. REED.

A Rack and Spiral Milling Attachment

The accompanying diagram shows a miller attachment for cutting spirals with an angle above 45 deg., and may also be used for cutting racks or any cross-milling jobs. We all know that changing over for odd jobs of this kind is one of the worries of a gang foreman, and this attachment saves most of the time usually required, as it can be put in place almost as quickly as the miller can change his cutter.

The diagram is self-explanatory, the gearing being a double-thread, ⅜-in. pitch worm, meshing with a 12-tooth worm gear, the worm being keyed on the regular arbor the same as a cutter, and driven direct without the back gears.



A RACK AND SPIRAL MILLING ATTACHMENT

WILLIAM SNOWDEN.

Sheffield, Eng.

The Design of Cams for Automobile and Marine Engines

A method I have used for obtaining the clearance angle of cams when a flat-faced valve plunger is used is shown in Fig. 1. The base circle of the cam is represented at *E*. The dotted line *C D* represents the face of the plunger when riding on the base circle of the cam. The line *A B* is the face of the plunger when the allowed clearance has been taken up. The lines *KM* and *JH* are then drawn through the point G_1 and tangent to the base circle at *P* and *R* respectively.

From the center of the base circle *FP* and *FR* are drawn to the respective points of tangency. It will readily be seen that the angles *PFG* and *RFG* are equal and are the clearance angles. To find the number of degrees in either clearance angle we refer to trigonometry. If the radius of the base circle is 0.6875 in. and the clearance is 0.008 in. we have the following:

$$Cosine \frac{PF}{FG} = cos. \frac{0.6875\ in.}{0.6875 + 0.008\ in} = 0.98849 = cos.\ 8°\ 42'$$

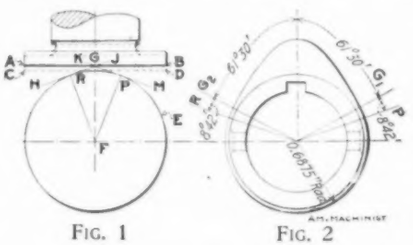


FIG. 1

FIG. 2

THE DESIGN OF CAMS FOR AUTOMOBILE AND MARINE ENGINES

DRAWING THE CAM

Having found the clearance angle to be 8 degrees 42 minutes, the cam is then drawn, as in Fig. 2, which shows an exhaust cam. The desired point of opening in this case is 123 degrees. The distances from *P* to G_1 and *R* to G_2 are the clearance angles and correspond to the lines *PG* and *RG* in Fig. 1. The lines PG_1 and RG_2 are tangent on the base circle at *P* and *R* respectively. The parabola is then constructed from the points G_1 and G_2. The clearance is therefore taken up in 8 degrees 42 minutes.

By this method the exact period of opening is obtained, and in assembling the engine all that is necessary is to place a piece of paper 0.008 in. in thickness between the end of the valve stem and the adjusting screw in the end of the valve plunger and screw it up and jam it with the jam nut. This method will eliminate further adjusting in the testing room.

WALTER H. STICKLER.

Cleveland, Ohio.

Tools for Holding Cutters

Considerable lapping enters the construction of high-grade machinery and tools. Some of the methods of holding work during the process are not always as good as they might be, and attempts to hold the work in poorly adapted tools sometimes result in injury.

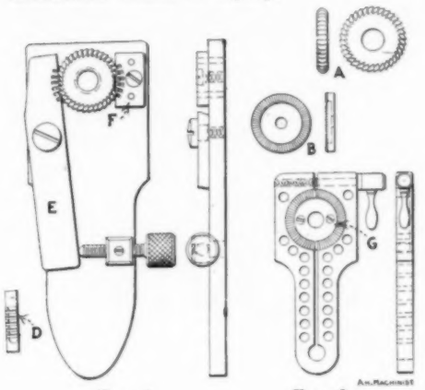


FIG. 1 FIG. 2

TOOLS FOR HOLDING CUTTERS WHILE LAPPING

The two cutters *A* and *B* are made in fair sized lots, and the holes in them must be of a uniform size. Although these holes are altered but little in hardening, it is preferable to leave about 0.001 in. to lap. Since no tools were on the job for holding the cutters I designed and made those shown in Figs. 1 and 2.

The lever *E* and the part *F* in Fig. 1 have one of the cutters to be held sunk into them, and are slotted as shown at *D*. They are located on the plate so that the cutter can be moved out toward the top. Very little pressure on the knurl-headed screw is sufficient to hold them. It is clear that various thicknesses and curves can be provided for by making the members *EF* to correspond.

The holder for the cutter *B* is shown in Fig. 2. To prevent any possible slipping in this case I made use of the defective cutter *G* by securing it to the bottom of the recess, then dividing it as shown. The bottoms of the teeth in the fixed cutter were cut as at *H*, so that the tops of the teeth in the cutter to be held would have no contact. The drilled holes reduce the weight somewhat. All parts of both holders were spring tempered.

Elgin, Ill. GUS HAESSLER.

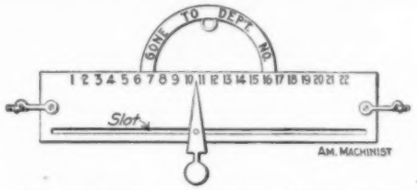
A Shop Locating Indicator

We have a large shop covering a considerable area, and it is frequently necessary for me to be absent from my department to see that work is being properly done elsewhere.

We have never been convinced that the interior telephone would be a success in our plant, and so I have devised the following method of showing where department foremen can be found, if they are not at home.

The illustration makes a man's location perfectly clear, as the pointer can be moved to show just what department he may be found in. These devices can be made at very low cost, if a quantity is required, and they save much waste of time waiting for the man in question to return to his own department.

Interior telephones seem to work out very nicely in many places, but in others



AN INDICATOR TO LOCATE FOREMAN OF SHOP

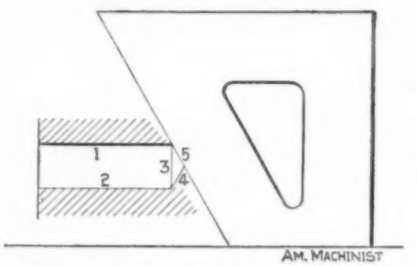
they are a source of annoyance and friction, owing to the fact that men do not appreciate the necessity of answering promptly, while the waits apparently multiply the actual time by about twenty, with a consequent irritation of the nerves of the party waiting.

WILLIAM GIBBS.

Brantford, Canada.

Inking in Drilled Holes

The cut shows a method of inking in a drilled hole on a drawing. The most natural way of inking in a drilled hole, is to ink the lines consecutively, as numbered. Number 5 would, therefore, be



INKING IN DRILLED HOLES ON A DRAWING

the last line to be inked, and with the ordinary 60-deg. triangle it is necessary to wait until the other lines are dry, which means a loss of time.

The cut shows a 60-deg. triangle with the 30-deg. end cut down. This enables the inking of line 5 without waiting for the other lines to dry, and prevents the likelihood of forgetting it altogether.

Germantown, Penn. C. SPENCER.

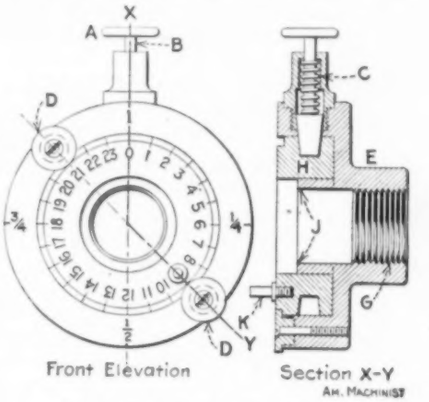
Index Plates for Lathes

We use an indexing faceplate in our shop for die work, templates, or work of any kind, the divisions of which will divide into 24.

The plate can be used for drilling templates by strapping it on a large lathe faceplate, then drawing the center line and circle needed, and dividing by means of the plate.

In the accompanying cut *A* is a knob or button ¾ in. in diameter; *B* is a stem tapered on the end to fit the notches in the index plate; *C* is a spring to hold the pin down; *D* shows two lock pieces for the index plate, and *E* is the body of the fixture.

The threads *G* are cut to fit the spindle of the lathe; *H* is the index plate 6 in.



INDEX PLATE FOR THE LATHE

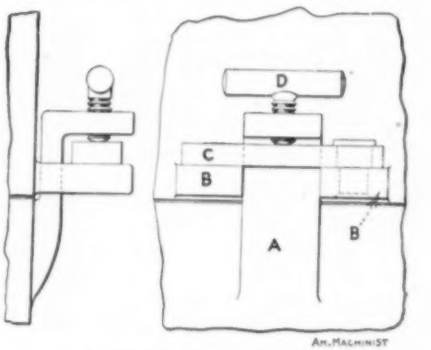
in diameter, ⅞ in. wide, with a 3-in. hole in the center. *J* is cut ⅛ in. below the surface to allow bolting on any suitable chuck, and *K* is a pin used to carry a dog.

Erie, Penn. E. T. BARTELS.

Clamp for Small Molding Flasks

When visiting a local foundry recently, I was greatly interested in an increasing pile of small molding boxes around a molding machine, and after watching the operator for a short time, I thought the clamping arrangement, illustrated in the diagram, helped greatly toward the output.

The cut shows front and side views of



CLAMP FOR MOLDING BOXES

one of the two clamps on each box. As will be seen, the lug *A* is part of the bottom half of the box, and the lugs *B* are part of the top, to which the swinging mild-steel link *C* is hinged. As the lugs *A* and *B* also take the place of the usual dowel or guide pins, they must be neatly fitted together for accurate location. To prevent the box being wrongly closed, the lug *A* should be about ½ in. wider on one

side of the box. To finally close the box it is only necessary to swing the link *C* into position and tighten the thumbscrews *D*.

The manager, who willingly gave me permission to publish this, also volunteered the information that he stole the idea from a foundry which keeps everything a dead secret, and improved it by substituting link *C* and the screw *D* for a wedge.

Belfast, Ireland. F. P. TERRY.

Wires for Measuring Threads

Having a number of screw gages to examine for diameter, depth and thickness of threads on the angles, I hit upon a simple method of holding the wires on the gage to measure the size on these angles.

The wires used for measuring were of certain diameter and bent into the shape shown at *E*, Fig. 1. One of these was placed on each side of the screw to be

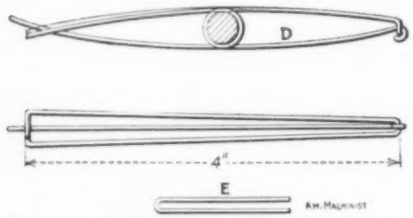
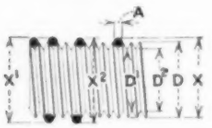


FIG. 1. WIRES FOR MEASURING SCREW THREADS



N = Number of Threads per Inch

D	N	D^1	D^2	A	X	X^1	X^2
¼	20	0.1875	0.1699	0.04	0.2733	0.2965	0.2977
5/16	18	0.2428	0.2235	0.04	0.3313	0.3501	0.3514
3/8	16	0.2965	0.2749	0.04	0.3883	0.4015	0.4029
7/16	14	0.344	0.3231	0.04	0.4436	0.4497	0.4512
½	12	0.3953	0.3666	0.06	0.5232	0.5563	0.5582
9/16	12	0.4576	0.4291	0.06	0.5907	0.6190	0.6204
5/8	11	0.5105	0.4794	0.06	0.6372	0.6693	0.6710
11/16	11	0.5728	0.5420	0.06	0.7097	0.7319	0.7334
¾	10	0.6239	0.5899	0.06	0.7649	0.7798	0.7815

AM. MACHINIST

FIG. 2. DIAGRAM AND CONDENSED TABLE

measured, and the micrometer applied. For sizes ½ in. in diameter, I found it rather awkward to hold the wires in position and apply the micrometer, so I bent some wire into the shape shown at *D*, Fig. 1, which explains the construction.

To apply: Place the two wires on the screw to be measured, bring the single wire around the opposite side of the screw and slip it over the bent ends. It is then fixed, and the micrometer can be applied with less difficulty.

An abridged table for Whitworth screw threads, taken from the "American Machinist Handbook," pages 29 to 37, where full particulars of tables is shown in Fig. 2.

JOHN J. STEWART.

Coventry, England.

A Turret Punch Holder

The turret punch-holder shown in the drawings was the result of a desire to eliminate changing tools on small lot jobs, and has been successful.

The punches in question are for keyseating or gaffing in countersunk holes for plow bolts. Four of them are press punches and one a cut-through punch. In other words the former compresses the metal while the latter cuts out the metal.

I believe the assembly and detail drawings are plain enough to the average

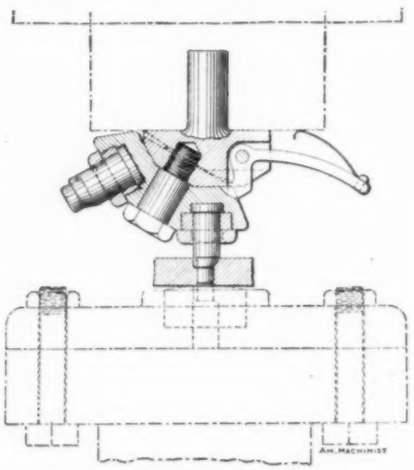


FIG. 1. TURRET PUNCH HOLDER

reader and for this reason will not indulge in a lengthy description. I would, however, call attention to what I call "Indicating Operations on Drawings."

The designer in working out the details of a device must determine how the pieces must be handled in machining; and where the piece is out of the ordinary I have always found it a means of saving a lot of time in the shop by showing the irregular operations.

You will notice that I have shown the full stock size in dotted lines, indicated the centers and given the necessary dimensions for their location. Before designing this device I tried to find one on the market but was unsuccessful, and so, desiring to save time, "got busy."

Canton, Ill. JOSEPH F. PFLUM.

Chuck with Auxiliary Jaws

The hub of a motor truck wheel is represented in Fig. 1. I was engaged in machining these hubs on an automatic turret lathe, gripping the hubs for one operation or setting on the boss *A* with a three-jaw universal chuck.

When machining the flange the hubs had a tendency to loosen in the chuck,

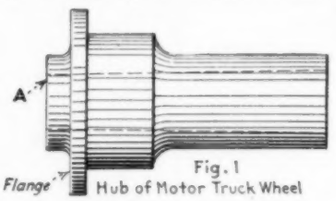


Fig. 1
Hub of Motor Truck Wheel

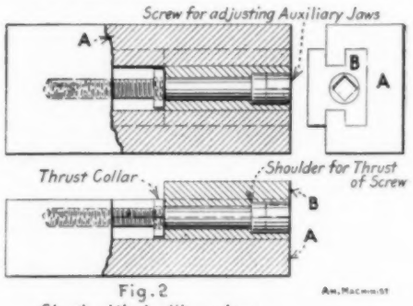


Fig. 2
Chuck with Auxiliary Jaws

for the reason that the cutting strain was too far removed from the point of support. To overcome this trouble I designed the auxiliary jaws shown in Fig. 2. The jaws on the universal chuck were removable, or in two parts rather.

Referring to Fig. 2, the part *A* is fastened to the chuck which serves as one of the jaws for gripping the hub; into this is fitted the auxiliary jaw *B*. This jaw grips the flange on its periphery. The chuck being universal the jaws *A* move simultaneously onto the hob, while the jaws *B* are adjusted independently.

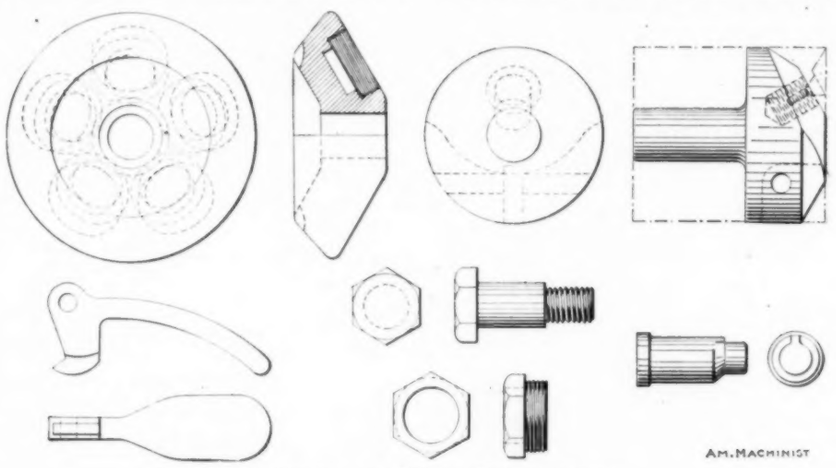


FIG. 2. DETAILS OF TURRET PUNCH HOLDER

Lina, Ohio. FRANK GEHR.

Discussion of Previous Question

Referring to letters and articles previously published

A Gang Tool Holder

In Vol. 34, page 1013, under the heading "Machining Locomotive Piston Packing" there was a halftone of a gang cutting-off tool which up to that writing had given very good service. Since then it has been improved in such a way as to eliminate the expense of forging and

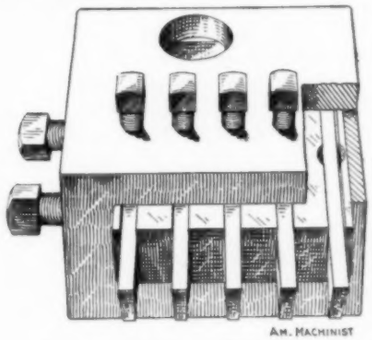


FIG. 1. IMPROVED GANG TOOL

FIG. 2. TOOL HOLDER IN PLACE ON THE BORING MILL

grinding new tools, and the time of setting them up.

The original tool-holder had a $1\frac{1}{32}$x$4\frac{1}{4}$-in. slot in it to receive ½x1 forged parting tools which had to be adjusted properly by the use of liners. The slot *A* in the toolholder shown in Fig. 1 was widened to 1½ in. to admit the smaller holder, shown at *B*. The smaller holder has five slots milled in it, to receive the $\frac{5}{16}$-in. parting tools, each being 0.004 in. apart by $1\frac{3}{32}$ in deep.

The slots are wide enough to allow the steel to go about $\frac{1}{16}$ in. below the top when in tight. This gives an opportunity to insert a piece of paper in the slot on one side of a tool to overcome any small irregularity, such as springing. In the small holder is a counterbore, for each setscrew in the larger holder, and when in place very little pressure is brought on the thin bottom by the two ¾-in. setscrews on top, as the entire binding of the tools is done by the five ½-in. setscrews.

The tool in position on the boring mill is shown in Fig. 2.

Springfield, Mo. C. E. PADDACK.

Lever End Designs

Having read the contribution of George E. Hall on the subject of "Standardization of Rod Ends," which appeared in Vol. 36, page 308, I take the liberty of criticizing in a friendly spirit the design which he has adopted.

The construction which he shows, has the disadvantage of depending entirely upon the friction between the shaft and lever, to prevent relative motion or slipping between them. In most machinery, these parts would bear an accurate and predetermined relation to each other, and in such cases, his design would hardly be satisfactory.

To obviate the possibility of such slippage, a design similar to that shown in Fig. 1 is frequently used. It will be seen, by comparing it with the illustration accompanying Mr. Hall's article, that the difference between the two designs consists of the introduction of a keyway in the lever end, for the reception of a Woodruff or a Pratt & Whitney key. This keyway should be located opposite the slot in the lever end, so as not to interfere with the clamping of the shaft.

For the retention of the clamp-screw, to prevent its vibrating loose, a lock washer may be used under its head, as shown in Fig. 1, or the screw may be replaced by a short bolt, with a nut and cotter pin, as shown in Fig. 2.

If the latter type of construction is adopted, the surface of the lever end upon which the bolt head rests, may be milled down so as to present an abutment or shoulder, adjacent to one of the sides of the bolt head, to facilitate tightening of the nut without the bolt being able to turn in its hole.

When it is desired to prevent side slippage of the lever on its shaft, in addition to maintaining the correct angular relation, a modification of the design shown in Figs. 1 and 2 may be utilized.

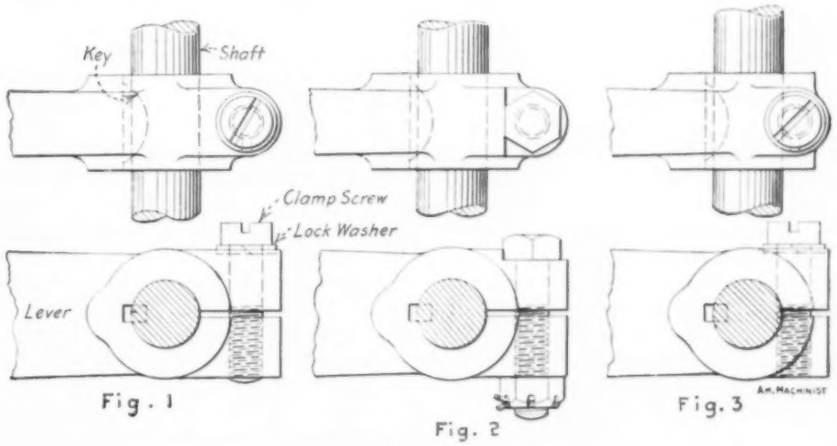
This construction is illustrated in Fig. 3, and the difference consists of moving the clamping screw in toward the center of the shaft opening, to a position that will cause the screw to intersect the shaft opening and fit into a groove in the shaft provided for its reception. With this type of design, the lever can neither move rotatively about the shaft, nor slip sideways.

As the proper proportion for the above designs may be readily determined by any designer, for various diameters of shaft, and to suit the particular case in hand, no tabulation of dimensions is given herewith.

Detroit, Mich. ARON LAWRENCE.

Machine Recorders

My article in Vol. 36, page 504, entitled "Scientific Management—A Suggestion," has brought me a number of letters, some commendatory, some otherwise. Reading them without reference to headings or signatures, it is easy to divide them into



LEVER END DESIGNS

two groups, one from the office, the other from the shop.

On the broad proposition, "Is the conservation of time and effort a worthy thing to accomplish?" the vote by both groups is "yes," by a large majority. The only point of difference between them is the natural one, relative to the ultimate destination of the saving which all agree must acrue from the use of modern methods.

Varying Opinions

Will it all go to the office? Some contend that it will, and strongly oppose what one terms "Another crack of the whip to increase dividends." No one suggests that it should all go to the shop, and two, one representing the office, the other the shop, voice the opinion that a just and equitable division of the savings thus obtained will go far toward settling most of the industrial differences that now exist. The office opinion says it will promote harmony and coöperation and the shop opinion thinks it will stimulate everybody to greater exertions.

This, of course, is the logical solution of a problem that has as many ramifications as there are viewpoints, and can easily be extended to cover the present high cost of living, improved home and social surroundings, better intellectual opportunities and the many other fine things that have become a necessary part of the environment that makes contented American homes.

The Important Point in Any System of Management

The ways for cutting time and increasing output are numerous. Technical papers are full of them. Scientific management is one. The use of machine recorders is another; but no matter what method is chosen, there is little danger of failure if the attitude of those interested is right. Perseverance and team work can accomplish wonders. I have expressed myself as favoring machine recorders for this work, and do so because they are comparatively inexpensive, and I know them to be practical and effective.

For those who have written to me about them, I wish to say there are several on the market, I believe, also that I have one, but it is not for sale. I designed it several years ago for personal use, and the experience I had with it was unique and convincing. While I have no present intention of placing it on the market, I am willing that others should be benefited by it, and any concern that wishes to improve shop conditions and will give the recorder a fair trial, can have the right to build and use as many as needed without cost. I will further assist, by furnishing a set of drawings, with full specifications, and be very glad to do so.

George F. Card.

Fort Wayne, Ind.

Capacity of the Prony Brake

In Vol. 36, page 527, F. A. Halsey writes on the capacity of the Prony brake, stating that the velocity should not be used in calculations. In a reference book of one of the leading correspondence schools, I find the following statements:

The amount of work absorbed by the prony brake depends upon the weight W, the length R (of the arm between pulley and weight), and the speed. If f = the coefficient of friction, p the pressure of the blocks and r the radius of the pulley, then f p r = W R. The work done at the face of the pulley equals the force multiplied by the distance or the pressure multiplied by the number of feet passed through.

Let N = the number of revolutions per minute. Then the distance passed through per minute equals $2 \pi r n$, and the work done equals $2 \pi r N f p$. Then as f p r = W R, the work done at the rim equals the left-hand side of the equation multiplied by $2 \pi N$, and to keep both sides equal we multiply W R by $2 \pi N$. The work done is expressed by the formula $2 \pi N W R$, and

$$\text{B.hp. (brake hp.)} = \frac{2 \pi NWR}{33{,}000} = 0.000194\ NWR$$

It seems queer that this formula should have stood for so long and been accepted by so many authorities. Do they all follow each other's lead blindly?

F. W. Brigham.

Springfield, Mass.

[Our correspondent has confused the method of calculating the power absorbed by a brake when running below its limiting capacity with the method of calculating the limiting capacity. The formula cited by him is correct for the purpose for which it was intended. When the power put into a brake, as calculated by this formula, exceeds the limiting capacity, the brake takes fire, and the data given by Mr. Halsey enables the limiting load at which firing takes place to be determined.—Editor.]

The Ventilating System of the Bosch Factory

I wish to call attention to two important points which we neglected to mention in the information sent you with reference to the ventilating and heating systems installed in the factory of the Bosch Magneto Co., and printed on page 787 of last week's issue.

The first point refers to the prevention of dust circulation, by means of the arrangement of the radiator casings. Ordinarily, radiators are set directly against the wall, creating a constant rise of warm air near the wall, which necessarily causes the cooler air lying close to the floor to follow, creating a draft along the floor. Inasmuch as work benches are generally set up close to the windows, the dust lying on the floor is constantly stirred up by the workmen's feet, and necessarily will be carried up past the radiator with the circulation of the air and distributed about the room. Furthermore, this arrangement will always cause a cool draft near the floor, thus creating an uncomfortable feeling for the workmen.

These conditions are entirely prevented by the arrangement of the radiator casings, referred to above. The cold air that has to be heated is always drawn from the vicinity of the ceiling, and is, therefore, clean, and the possibility of collecting dust near the radiators is entirely eliminated. The fresh air flowing about the radiator will also be kept clean. This, in connection with the exhaust of the air from the workmen's rooms through the lower louvers, near to the floor, is an efficient means of keeping the air in the factory clean and free from dust, an important point both in regard to manufacturing and sanitary conditions.

The other point we would like to mention refers to the shutting off of the exhaust fans in case of fire. Should it happen that a fire broke out in any of the working rooms, the draft caused by the exhaust fans of the ventilating system might prove dangerous to the workmen, inasmuch as the smoke from the fire would be drawn toward the stair wells and cause them to be filled with smoke.

To prevent this, arrangements have been made on each floor, so that the fans may be stopped instantly. A switch, operating the circuit breaker of the electric motors that drive the fans, is conveniently located on each floor, and the fans can, therefore, be shut off with very little delay.

Albert Klein,
Construction Engineer,
Bosch Magneto Co.

New York, N. Y.

Increasing Gas Furnace Temperatures

In connection with the article published under the above title at page 566, we should like to point out that the air heater described is identical in principle with our patent air heater.

We have been in the habit of fitting this heater to our gas and oil hardening furnaces, for high temperatures, for some years past.

Aldays & Onion
Pneumatic Engineering Co.

Birmingham, Eng.

The trackage of the United States, 350,000 miles, would build a railroad from the earth to the moon, and 100,000 miles beyond, or 133 transcontinental railroads. The rails of the 350,000 miles of our tracks weigh approximately 43,000,000 tons, and would counterbalance the weight of three-fourths of the people of the earth. There are enough to form eighty-two steel roads with which to skewer the earth.

Machine Tool Builders' Convention

Following the custom of the past two years, the semiannual convention of the National Machine Tool Builders' Association was held in Atlantic City, May 16 and 17. The attendance was satisfactory, numbering over 100 registered members and guests.

The following eleven firms were admitted to membership: A. D. Quint, Hartford, Conn.; Landis Machine Co., Waynesboro, Penn.; the Hisey-Wolf Machine Co., Cincinnati, Ohio; the Grant Manufacturing & Machine Co., Bridgeport, Conn.; the Geometric Tool Co., New Haven, Conn.; Gooley & Edlund, Syracuse, N. Y.; Joseph T. Ryerson & Son, Chicago, Ill.; Langelier Manufacturing Co., Providence, R. I.; Baird Machine Co., Bridgeport, Conn.; Armstrong-Blum Manufacturing Co., Chicago, Ill.; Acme Machinery Co., Cleveland, Ohio.

Five firms recorded changes in firm names as shown by the following list, which gives both the old and the new names:

Changes

Treadwell Engineering Co., Ex Stoever Foundry & Manufacturing Co., Easton, Penn.; Flanders Manufacturing Co., Ex Grant & Wood Manufacturing Co., Pontiac, Mich.; Conover-Overkamp Machine & Tool Co., Ex Miami Valley Machine Co., Dayton, Ohio; Reed-Prentice Co., Ex F. E. Reed Co., Prentice Bros. Co., Worcester, Mass.; Jones & Lamson Machine Co., Ex Fay Machinery Co., Springfield, Vt.

The Committee on Standardization reported at length through D. M. Wright, chairman, recommending that a Standardization Commission be appointed to take up the matter of standardizing nomenclature, proportions, and other features in connection with machine tools. The resolution authorizing this commission was adopted at the last session of the convention. It provides that all recommendations are to be submitted to the members at least six months before they are brought up for final action. It further requests that similar committees of other societies be invited to coöperate in establishing standards.

A paper containing many valuable suggestions, entitled "What Can the Association Do for Its Members?" was presented by James H. Herron, the newly appointed general manager of the association. Attention was called to a number of important activities that might well be taken up, and which would benefit the entire membership as well as be of value to the machinery-building industry in general.

Among these should be mentioned standardization in its broadest sense, the safeguarding of machines built by members of the association, the accumulating of statistics applying to the machine-building industry, both in this country and abroad, the compiling of a technical index to be maintained in the office of the secretary. From the section devoted to the matter of standards, we quote:

Satisfactory growth of the association is shown by the admission of eleven firms to membership.

A resolution was adopted authorizing a commission to take up the subject of standardization of machine tools.

There are many other apparently unimportant details of machine tools that could be similarly standardized. If a movement were inaugurated at once to determine standards for these simpler things, would it not be conducive, not only to the welfare of the user, but lessen the cost of manufacture in the plants of the members of this association? As a rule, these minor matters are turned over to some draftsman, who makes them according to his idea. When we get the numerous ideas of the numerous draftsmen, there is certainly confusion.

All such standards developed under the auspices of this association could be known as the "National Machine Tool Builders' Association Standards."

Need of a Technical Index

Mr. Herron's reference to the usefulness and need of a comprehensive technical index is so well put that it is quoted below in full:

Many of the members of the association at times have problems that they prefer to have their own engineering force develop, but there seems to be a lack of information of a reliable character to draw from. The technical press is constantly publishing articles that would be of interest to our members, and in my experience I have found that comparatively few concerns keep an index even of articles that interest them particularly. Generally no one is delegated to read the articles, pass upon them and index them in any form that might render them available at a future time.

Why cannot this association maintain an index of all technical articles upon such subjects as might be of interest to its membership?

Such an index would be a very valuable addition to the association's work. The members, individually, would feel that they have a source of information of a reliable character and available for immediate use. This would, of course, necessitate the perusal of a large number of technical papers weekly and monthly, but I believe this could be done and such an index maintained in the secretary's office.

It is said, "That education is not in actually possessing definite information on the subject in question, but to know where to look for such information when it is needed."

The paper of Fred E. Rogers, editor of *Machinery*, on "How Can the Mechanical Journals Be Made the Most Valuable to Their Patrons," contained many valuable suggestions. It called attention to the difference between trade and technical journals, pointed out the value of the reading pages and also devised the making of the advertising pages as interesting and instructive as possible. He spoke of the advantage to any manufacturer of taking photographs frequently, showing work in process of construction.

Trade Secrets

Under the heading of "Trade Secrets," he said:

One of the troublesome things that gall editors is the attitude of many manufacturers toward trade secrets and alleged trade secrets. We realize that commercial prestige and success in some cases depend upon keeping certain processes and methods closely guarded, but in the manufacture of metal products there is very little, indeed, that is not known to a large number of men well versed in their trade.

The plant that excludes visitors in order to keep its specialized knowledge in, by that policy generally keeps out the knowledge of what is going on elsewhere. A close corporation—close in the sense of keeping its methods secret—will eventually die of dry rot.

A policy of secrecy puts the management at the mercy of its superintendent, foremen and workmen. The speaker has found in a few cases that the superintendents foster the idea that many of the methods introduced by them are original and should be carefully guarded, when as a matter of fact they originated elsewhere.

These employees build themselves up by deceit and lull the management into a state of fancied security when their supposed monopoly of special processes has existence only in their imaginations.

How to Preserve a Secret

Now as to the best policy to accord to editors in regard to real secret methods: It is my belief that the best way to guard them so far as publicity is concerned is to take the editors of reputable journals into your confidence and show and explain to them the general principles employed. You will thus preserve the methods from publication in the first place if they are actually known only in your plant, or in the second place may learn that you have been deceived and that your supposed secret is no secret at all.

To illustrate how effectively the confidence of a manufacturer may safeguard his interests, the following example is taken from personal experience:

A manufacturer of small tools notable for his courtesy to visitors some years ago personally conducted the speaker through his plant and in the course of the inspection showed him the principal features of the tool-making practice followed in making certain tools. This work was of extraordinary interest, and

permission was asked to publish a description, which was courteously denied for good and sufficient reasons.

In the course of a few weeks the editor received a contribution describing minutely a system of making tools that seemed strangely familiar and which upon close reading was recognized as a literal description of the practice of the concern mentioned, although no name was given. Of course, we could not publish that article much as we wanted to.

If our friend had not taken us through his plant and shown us his practice, we would have known nothing about it and would naturally have published the contribution. The fact that the article has never been published elsewhere leads us to suspect that other editors have also been muzzled in this very effective manner.

Analysis of Past Trade Conditions

A careful, detailed analysis of trade conditions, extending over a period of 85 years, was given in an address by General Secretary Charles E. Hildreth. The statistics from which conclusions were drawn were those of the pig-iron industry. After explaining a chart on which these data were plotted, and calling attention to numerous, important, recent developments, Mr. Hildreth summarized as follows in answer to the question forming the title of his paper, "What the Future Has in Store for Us":

> This [the recent developments], with the showing on the chart of the three recent advances of prices in Philadelphia, makes us hope that the country is going to be sane this summer and fall and reap the harvest the natural demands are crowding upon us. If we are not I am very much afraid we shall find business following the downward trend as indicated on our chart.
>
> But I have a greater faith in the American people than to believe this will come to pass. The only definite prediction I can make is that when the country does settle down and confidence returns, conditions are such that the machine-tool industry will have the greatest volume of business in its great and glorious history.

The closing address of the convention was made by Charles E. Carpenter, general manager of E. F. Houghton & Co., Philadelphia, Penn., on "The Value of a Home Organ as an Advertising Medium."

Resolutions, suitably engrossed, were adopted and presented to Fred E. Geier, and C. Wood Walter in recognition of the work done this past winter in connection with the tariff hearings at Washington.

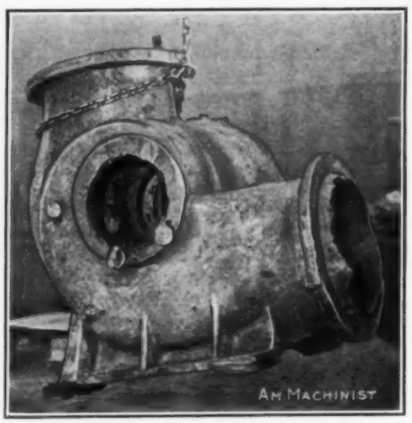
A Large Bronze Casting

Special Correspondence

The illustration shows a very large bronze pump casing, which was made to take the place of an iron casting that had been destroyed by corrosion of acid and salty waters. The illustration shows the casting in the rough just as it came from the sand and before it was chipped or cleaned up in any way. The pump for which this casing was designed is used in connection with dredging work in and around New York Harbor.

The pattern used to make this casting was made in the form of a shell so that the inside could be used as a core-box, to reduce the pattern expense as much as possible. Extra detachable pieces were, of course, used in order to secure the full-sized cope lens on the core.

The casting was made in an extra-heavy, special wooden flask, molded together, and was poured at two points from large ladles. Something over 4400 lb. of metal was melted to pour the casing, which weighed between 3500 and 3600 lb. An idea of the size of the mold can be gained from the fact that the cope, which had to be lifted off, weighed approximately five tons. The casting was made by the Atkinson Co., Rochester, N. Y.



A Large Bronze Casting

Purchase Your Small Parts

By Percy Ford-Smith

Many pieces produced on a turret lathe could be produced much cheaper by other processes, or by the use of other bar stock. Where quantities are very small the following remarks do not always apply, but even then these parts can often be purchased ready for assembling cheaper than the actual cost of raw material alone, to say nothing of the labor and overhead charges, when made out of solid bar stock in a turret lathe.

It would certainly be interesting to any machine-shop superintendent to make blueprints of the work done on turret lathe (especially if pushed for these parts) and pick up the long pieces or those with much reduction of stock and get quotations from firms specializing on this product. Comparison with his own costs of material and production will, in most cases, give him a very rude shock.

The companies specializing in this class of product, only, are using electric welding machines, forging machines and hot and cold swaging machines, eliminating a waste of material which will often allow them to sell at less than the cost of a piece of solid stock, to say nothing of the work of reducing and finishing in a turret lathe.

My attention was drawn to one of the latest hexagon turret lathes, making ⅞-in. round-head bolts, 6 in. long from 1¼-in. black round stock. Apparently great results were being obtained in production. The roughing tool was reducing from 1¼ to ⅞ in. at one cut, leaving just enough to finish the size, and the motor was putting out close to 10 hp. The other operations were, turning the head, threading and cutting off.

The time was excellent without doubt. However, contemplating the enormous amount of stock being cut up into chips, I took the matter a little further, getting a price from a nut and bolt manufacturer. The price of these bolts, delivered, ready for assembling, was just $1.10 per hundred more than the cost of the bar stock, which was used for making them on the turret lathe. At that, the $1.10 would have to cover the upkeep of the machine, interest on the money invested, supervision, wages, power and all the other incidentals which would in practice be fully ten times this amount.

This is a typical example and applies to much turret-lathe work. The subject will bear investigation by any superintendent wishing to reduce his cost of production, or who is, at present,hard put to it for turret-machine work.

The original "water ram" of Montgolfier was serviceable only for small volumes, as the repeated action of the water hammer strained the machine, and especially when the diameter of the valves exceeded 1½ in. An improvement on Montgolfier's apparatus was brought out recently by Adolph Abraham, a German surveyor of public works, who, instead of battering or hammering valves, provided a revolving valve that brings the power water in regular turns in connection with the discharge conduits. This device is called the hydropulsor. When the entering or power water has reached its utmost velocity of flow, the revolving valve makes a turn, thus bringing the impulse of the power water to bear on the water standing in the discharge conduit, lifting it beyond its level and causing it to overflow at the orifice. Owing to the work thus performed, the pressure at the intake subsides, thus causing the revolving valve to make another turn, whereupon the pressure water flows in a second time, accomplishing a new acceleration and a repetition of the former process, which is renewed indefinitely.

A Floating Work-Holder for the Disk Grinder

The Pacific Electric Heating Co., Ontario, Calif., is using a floating work-holder on the geared lever feed tables of a Besly grinder, for grinding the top side of its electric sad-iron castings. On this work it is not necessary to grind to size or exactly parallel. The surface must be straight and flat and the manufacturing cost low.

to tip forward into the grinding disk. This feature aids in the quick handling of the work and also makes a noticeable saving in wear on circles.

Workmen are paid by the piece and furnish their own circles; that is, the cost of the circles is charged to the workmen. The piece price is arranged to make a fair allowance for circles used.

It will be noted in Fig. 1 that the workmen carry sections of cloth buffs on their hands to protect them, as the work becomes quite warm in grinding

FIG. 1. GRINDING SAD IRONS, USING A FLOATING WORK-HOLDER

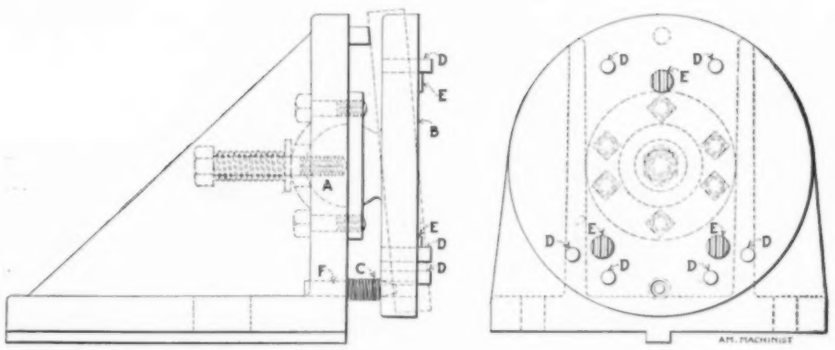


FIG. 2. FLOATING WORK-HOLDER FOR BESLY GRINDER

The work-holder used for this job is shown in Fig. 2. It is of the floating type, using a ball-and-socket joint *A*. The use of this device allows the ground surface to clean up with the removal of the minimum amount of stock and practically doubles the production as compared with the use of an ordinary rigid angle plate. The two workmen shown in Fig. 1 are turning out ten finished surfaces per minute, from the rough.

When not under pressure, the faceplate *B* is tilted backward, by means of the spring *C* at the lower edge; there is therefore no tendency for the thin work and edges of castings are sharp from a previous edge-grinding operation.

This is a type of work-holder which can be used to good advantage on a great variety of disk-grinder work. The work is located and supported on the face of the holder by means of the pins *D* driven into the faceplate *B*. Where the back of the work is rough and uneven, it may be backed up by the three pins *E* projecting from the face of the work-holder, so the uneven surface will seat itself on this three-point bearing. The pin *F* prevents the faceplate from rotating.

Grinding Brass, Bronze, Aluminum and Other Alloys

To develop a wheel that will successfully grind brass, bronze, aluminum and other alloys is one of the most difficult problems that grinding-wheel manufacturers have endeavored to solve. Greater success has been obtained in grinding these since the development of modern electric-furnace abrasive materials.

The information contained in this article is based on facts brought out in a paper read before the Norton Co.'s 1912 Sales Conference by George W. Thomson, the company's representative in a territory where there are a great many foundries and manufacturers using these alloys.

Mr. Thomson supplemented his paper with samples of castings of the various alloys, which samples had been given a thorough test in the company's Department of Tests for the purpose of deciding on a grain and grade of wheel, and the kind of abrasive material that would grind them most efficiently.

GRINDING BRASSES AND BRONZES

Brass and bronze were forerunners of all casting alloys. It is now necessary, however, to distinguish between numerous kinds of brass of high and low zinc content, red and yellow, bronze, naval brass, malleable brass, aluminum brass and many others. The term "bronze" was formerly employed to indicate an alloy, the only constituents being copper and tin—copper predominating; but in recent years almost every combination of metals possessing strength and toughness may be described as bronzes.

In trade circles, brass is generally understood to mean an alloy of two-thirds copper and one-third zinc, but in everyday foundry practice it is found to contain other metals besides copper and zinc. The copper content may vary from 60 to 88 per cent. of the whole mixture; likewise the amount of copper and tin in bronze varies.

While very desirable qualities for mechanical purposes are obtained by the alloying of zinc, tin, lead, iron, manganese and nickel to copper, with but two exceptions the resulting alloys show very little difference in their action on a grinding wheel of the correct grain and grade. The exceptions are nickel bronze and bell metal—two of the hardest alloys. These can be ground with fair success on the same wheel as the other alloys, but where the quantity of this material coming through will warrant it, it is recommended that a special wheel of correct grain and grade be used.

The content of nickel in nickel bronze and tin in bell metal is sufficient to make them very hard. On nickel bronze, a wheel made of crystolon, grain 24, grade Q gives very good results; and for bell

metal, a wheel made of the same material but of a little harder grade will give equally good results. Nos. 24 and 30, grade R wheels are recommended. Comparatively thin wheels are, as a rule, used on bell metal work and the corners are used to quite an extent. The work is, therefore, severe on the grinding wheel.

An experience in grinding brasses and bronzes with two crystolon wheels will be of interest. A 14x2-in., 24-Q and 14x2-in. 30-P were placed on the same arbor in one of the largest commercial foundries in Connecticut and used ten hours a day, every day in the week except Sunday, on all shapes and kinds of brasses and bronzes. These wheels were watched very carefully—almost daily—and no noticeable wear could be found for several days. They have been running eight months, and at this writing measure 12½ in. in diameter. The dresser has not been used on either wheel during this time. The 30-P looks to be working a little the better; the 24-Q not working quite as free and clean.

ALUMINUM

This alloy is ductile, malleable and tenacious. In the automobile industry, where light castings are important, alloys containing aluminum and zinc are largely used. In this class of work crystolon elastic wheels grain 36, grade 4, have been giving very satisfactory service. This wheel has shown best results from tests conducted on automobile parts such as the lower part of the crank case, crank case cover, transmission case, upper and lower float chamber and exhaust pipe. This wheel was found to remove the metal faster and load the slowest of all wheels tried, and at the same time save a good surface. Grade 5, elastic process, has also shown some good work.

NICKEL BRONZE

When experimenting on this alloy, the same wheels were used that were tried on the brass, standard bronze and aluminum.

A feature to be noted, on account of its usual absence in connection with grinding brasses and bronzes, was the formation of very dull red sparks which were quite dense just under the point of contact. These sparks became invisible at approximately four inches from point of contact.

All wheels heated the work very quickly and felt "hard;" in fact, this bronze appeared much harder than any of the other brasses or bronzes. The wheels all loaded about equally. The 24-Q and 30-P wheels were the best cutting wheels, perhaps, the 30-P doing the better work, although both were about equal.

GOVERNMENT BRONZE

This alloy also gave off a very dull, red spark, but was not as noticeable as in the case of nickel bronze. The 30-P was the best wheel as it took hold well, did not load half as much as the 24-Q, although used more, nor did it feel as hard as did the 30-O and 36-P. A characteristic of these wheels was that the alloy loaded the wheels in small spots less than the size of a pinhead.

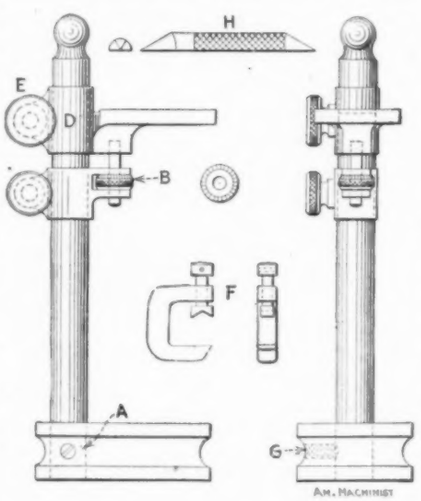
Experiments showed that aluminum loads a wheel more than the other alloys here referred to; phosphor-bronze next, standard foundry bronze and government bronze about the same, and nickel bronze the least. All wheels tried were 14x1½x1¼-in. and were run at 1360 r.p.m., or 5000 surface feet per minute.

A 30-P crystolon wheel is recommended for the snagging of all kinds of brasses and bronzes in ordinary commercial foundries. This does not apply, of course, to foundries that melt up one kind of metal for a special purpose. In cases of this kind, it would undoubtedly be policy to test out, say 24-P, 24-Q, 30-P and 36-O crystolon to determine which is best adapted for the work.—*Grits and Grinds.*

Height Gage of Novel Design

BY W. C. BETZ

The height gage shown in the cut will be found very handy whenever such a tool can be used. It can be set accurately and verified by a pair of outside micrometers, and adjustment of 0.001 in.



NOVEL HEIGHT GAGE

can be had by turning the nut *B* in either direction.

The base, spindle and table are tool steel, hardened and ground as follows:

The hole *A* in the base is lapped to size and the spindle is ground to a light drive therein; the spindle with the base in position and fastened by the screw *G* is placed on the universal grinder and the bottom of the base is ground to a perfectly flat surface with a saucer-shaped wheel; this brings the base at absolutely right angles with the spindle.

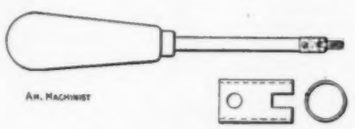
The hole in the table *D* is next lapped for a sliding fit on the spindle; it is fastened thereon in any position by the screw *E* and ground off on a surface grinder, after which it is removed and lapped to a perfect surface.

The scriber *H* is made of tool steel, hardened, ground and lapped on the bottom and is handy for laying out jigs, dies and work of a similar character. It will also be found handy to scribe from size blocks. The clamp *F* is used to fasten the scriber to the table.

A Useful Screwdriver

BY JAMES T. STONE

On a certain job we find it necessary to use small screws in a hole of small diameter, making it difficult to manipulate the fingers. To accomplish this, I



FOR DRIVING SCREWS IN CLOSE QUARTERS

turned the screwdriver down until it was just a little less than the diameter of the screw head; then on the end I fixed a split bush into which the screws were pushed, the screw slot, of course, fitting on the screwdriver. This held the screws from falling and we easily screwed them home, after which the screwdriver was easily slipped off.

Iron and steel exports will show for the present fiscal year a total export of over a quarter billion dollars, as against 231 million in 1911 and less than 100 million in 1902 according to figures of the Bureau of Statistics. Nearly all its constituent items participated in the growth of approximately 20 million dollars indicated for the year's exports. Structural iron and steel in nine months showed a total of 7½ million dollars, an advance of 2 million dollars over the like period of 1911; wire, 8⅔ million, an increase of 1⅓ million dollars; builders' hardware and tools, 13 million, an increase of a half million dollars; machinery of various kinds, including electrical, metal-working, mining, shoe, engines, sewing machines, cash registers, typewriters, adding machines, etc., 83 million dollars, against 74¾ million in the nine months of 1911; sheets and plates of iron and steel, 15¾ million dollars, an increase of 5 million over a like period of 1911; and tin plates, 4 million dollars, against 1⅓ million in the corresponding period last year.

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Of this issue, 22,000.

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OUTLINE OF TOPICS, PAGE 149

American Machinist

The Cost and Effect of Changing Men Frequently

Nothing is more demoralizing to a shop or reduces production more than an irascible foreman or superintendent. The greatest mechanical ability in the world will not offset the effects of a bad temper or favoritism.

When men know that they are likely to be discharged instantly at the whim of a foreman, or publicly berated with choice cuss words if something goes wrong, they do not, and cannot, give their best services. The knowledge that the support of their family can be jeopardized by such a foreman adds more dollars to the cost of production than we are apt to realize.

While a foreman must control his department if we are to hold him responsible for the work, the power to discharge should not be lightly given or used. A man's good record should count in his favor, even if he has made a grievous blunder. For it is well to remember that a man seldom makes the same mistake twice, while a new man would be very apt to do the same thing.

If we remember our own shortcomings in many things, we are not so apt to look for perfection in the men who work for us. It is a mistake to even expect them to know as much as we do about the work, for if they did the chances are we would be working for them.

We must take the best men we can get for the price we feel we can pay and try to show them, or train them to do the work, so as to secure the results desired. It should be remembered that when we discharge a man we are throwing away all the training we have given him, so far as we are concerned, and that someone else will benefit by it. We should see that it is better to put up with some failings than to spend the time teaching a new man, and that there is every chance that the next man will not be much, if any, better.

Leaving the welfare of the man out of the question and considering only the cost of producing work, it is better to refrain from changing men as much as possible. The doing of any kind of work day after day brings a certain dexterity which comes in no other way. It develops little kinks or "know how" that cannot always be recorded as "accumulated data," and which a new man must learn from experience in the same way.

Remembering that the object of business is to turn out work at low cost and that rules and discipline are merely means to that end, we must consider the question of changing men more carefully. The old employee often has a value which cannot be expressed in dollars or paid for in a like manner. A kindly consideration for his comfort and well being retains his loyalty and coöperation and pays big dividends on the investment.

The Boy's Income

One of the major articles in this issue deals with industrial education in New England. It is a review of the beginnings and growth of publicly supported industrial schools, mainly in Massachusetts and Connecticut. It shows that trade or industrial education is already well begun. This is a source of gratification. It also shows that there is a number of problems yet unsolved. We quote:

> The problem of making this training available for the boy who cannot afford to sacrifice any part of his present income, no matter how great the future reward, has not yet been solved.

Upon this fact hinges the opinion that has been expressed in these columns, that the full-time trade schools are not of the type that will finally solve our important problems of trade education. Such schools are undemocratic, due to the fact that they are not available to all of the boys in a given community. Their advantages can only be enjoyed by the boys whose parents can support them while they are going to school.

Our final scheme of trade education must be suited to every boy. The poor boy must have an equal chance with his fellow who comes from a richer home. This means that the boy must be able to earn something during the training period. The only way in which he can earn it is by working. It, therefore, appears that some system which combines shop work, where the boy earns a little money, with proper classroom instruction, is the basis of a solution of our problem.

The failure of the full-time day school to measure up to the situation is shown by the following quotation from the article previously mentioned:

> The full-time day school cannot hope to attract many of the boys who most need this training, unless some way can be found for them to earn some small wage either in or out of the school.

It appears that the part-time trade school meets, at least to a degree, the necessity of the poor boy, who needs trade education most. It combines shop training, the learning of the manual part of the trade in a commercial atmosphere, earnings from work to meet the boy's need of income, and classroom instruction. Mr. Fish, the contributor to whom we have referred, however, does not look kindly upon the half-time plan. He writes:

> Half-time education, where the shop work is done under private auspices, is lacking in continuity of purpose and correlation of shop and school, and is, therefore, not likely to give its graduates the power to rise that belongs to the graduate of a corporation apprentice school or a public full-time school.

This states that the part-time plan, though meeting the boy's economic needs, lacks a proper coördination between the shop work and classroom instruction. A half loaf is better than none. Therefore, at the outset we can say that the part-time plan is better than none. If this plan can meet the boy's need for income while learning his trade, it should not be a serious matter to harmonize the shop work and classroom instruction and bring about a satisfactory course of trade learning.

We do not belittle the full-time schools. They are doing a good work, and deserve our hearty commendation. But they cannot meet our great need. Thus, the part-time schools have their peculiar field, one that the others do not and apparently cannot reach.

New Publications

ESSENTIALS OF LETTERING. By Thomas E. French and Robert Meiklejohn. Ninety-four 6x9 pages. Illustrated. Third edition, revised. McGraw-Hill Book Co., New York City. Price, $1.

The volume under review forms a very useful reference book on lettering for draftsmen engaged in the various branches of engineering—mechanical, civil, architectural—and also contains an abundance of useful information to the artist, designer and craftsman.

The book is divided into nine chapters, logically arranged, and each in itself leaving little to be desired on the respective phases of the lettering art.

The first two chapters present an analysis of the proportion and construction of the Roman, Old Roman, Renaissance Roman, Modern Roman, Commercial Gothic and Stump letters. There is interspersed valuable information that should enable the reader to avoid the common errors made by the draftsmen. The order and direction of the strokes are clearly indicated on the letters given as illustrations, and considerable attention is devoted to the inclined single-stroke letters, with complete information as to the "make-up." A point worthy of serious consideration in any drawing room is the claim made by the authors that the inclined lettering stands out more clearly by contrast with the horizontal and vertical lines of the average mechanical drawing than letters of the upright style.

Chapters 3 and 4 cover the principles governing the composition, titles and selection of styles for machine, architectural, map drawings, etc., illustrated with very neat samples. The next two chapters are devoted to the wider field of lettering, wherein the designer and decorative artist are made familiar with the distinctive features of the letters of the different styles and periods. The samples are: Old Roman, Light-Face German, German Uncials, French Uncials, Compressed and Extended Uncials, Missal type, Celtic type, and some remarkably nice reproductions of manuscript letters of the eleventh and fifteenth centuries in the Gothic style, the Old English, English Gothic and Old "German Text."

In chapter 6, the artist will find valuable data on the laws of design for inscriptions, title pages, etc., and the comments on the choice of letters for different purposes are especially interesting. Chapter 7 contains some clever and original combinations in monogram or cipher. The next chapter covers the essential points and rules for drawing for reproduction, while the last chapter consists of the bibliography, giving a list of books on the history of the alphabet and the titles of the well known works on lettering for various purposes.

The book covers the lettering art in a manner both thorough and interesting.

Reorganization of Waltham Watch Tool Co.

The business and property of the Waltham Watch Tool Co., Springfield, Mass., has been purchased by a new corporation recently organized under the name of the Van Norman Machine Tool Co.

The incorporators and officers of the new company are Frank H. Page, president; Charles E. Van Norman, vice-president; Clarence J. Wetsel, treasurer; Fred D. Van Norman, secretary.

The Waltham Watch Tool Co. was founded by the Van Norman brothers. Mr. Wetsel will be remembered as treasurer and general manager for a number of years of the Baush Machine Tool Co. Mr. Page, president of the new corporation, is also president of the National Equipment Co.

The new company will continue to manufacture the Van Norman line of machine tools and contemplates an extension of the line.

Horton Chuck Consolidation

On May 9 purchase of the E. Horton & Son Co. was affected by the S. E. Horton Machine Co., both of Windsor Locks, Conn. The business will be conducted under the former's name.

The management of the business will now be in the hands of Sidney Ellsworth Horton, son of the late Stoddard Ellsworth Horton, and grandson of Eli Horton, founder of the business. Mr. Horton has been actively identified with the business since 1891, having been superintendent of the plant of the E. Horton & Son Co., from 1896 to 1905. For the past few years he has been carrying on the business of the S. E. Horton Machine Co.

It is 62 years ago that Eli Horton and his son, Stoddard, started business in Windsor Locks, patenting and making the first geared universal chucks ever designed.

Conference on Industrial Diseases

The second national conference on industrial diseases is to be held jointly by the American Association for Labor Legislation and the American Medical Association on June 4 and 5 at the Marlborough-Blenheim, Atlantic City, N. J.

The following papers have been announced: Temperature and Humidity in Factories, Royce W. Gilbert, sanitary engineer, Boston; Air Impurities—Dust, Fumes and Gases, Charles Baskerville, College of the City of New York; Effects of Air Conditions Upon Health of Workers, George M. Price, medical director Factory Investigating Commission of New York State; Psychological Factors in Human Efficiency, Prof. Hugo Munsterberg, Harvard University.

Other sessions are to take up industrial diseases, Tuesday morning, June 4; the state promotion of industrial hygiene, Tuesday evening, June 4, and industrial diseases, Wednesday morning, June 5.

Cincinnati Section of the American Society of Mechanical Engineers

A local section of the American Society of Mechanical Engineers was organized in Cincinnati, Ohio, May 13, the following officers being elected: Chairman, A. L. DeLeeuw; vice-chairman, J. B. Stanwood; temporary secretary and treasurer, John T. Faig.

Personals

H. G. Dreses, of the Dreses Machine Tool Co., Cincinnati, Ohio, sails on May 25, for an extensive European business trip.

F. J. Mawby has resigned his position with Wales, Bray & Co., of New York, and joins the Buffalo branch of the Fairbanks Co.

George Hogan, who has been for some time connected with the Frontier Iron Works, Buffalo, N. Y., has assumed the duties of general sales manager, vice W. Robertson, resigned.

C. A. Nourse has resigned as general superintendent of the American-LaFrance Fire Engine Co., Elmira, N. Y., to accept the superintendency of the Reed-Prentice Co., Worcester, Mass.

W. S. Quigley, until recently vice-president and general manager of the Rockwell Furnace Co., New York City, has organized the Quigley Furnace & Foundry Co., 50 Church St., New York City.

Adolph Brion, president of Peter A. Frasse Co., New York, has returned from an extended trip through Europe and a visit to the steel works of the Poldi Co., of Austria, of which his company is the representative in this company.

Irving H. Reynolds, until recently vice-president and general manager of the William Tod Co., Youngstown, Ohio, has joined the Allis-Chalmers Co., and will act in the capacity of engineer and manager of the steam and gas-engine departments.

John W. Hill, until recently chief draftsman of tools, with the American Locomotive Co.'s Providence plant, has become connected with the Bantam Anti-Friction Co., Bantam, Conn., with whom he will act in the capacity of sales engineer.

W. Robertson has resigned his position as general sales manager of the Frontier Iron Works, Buffalo, N. Y., in order to organize and act in the capacity of president and manager of the W. Robertson Machine & Foundry Co., Buffalo, N. Y.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Vertical Spindle Miller

This machine consists of a bed, supporting a work table; to the bed is attached an upright which in turn carries a suitable overhanging arm or crossrail. The spindle, carried in a saddle on the overhanging arm, has a horizontal movement.

The table has a work surface 6 ft. long and 18 in. wide, surrounded by a trough. It has four T-slots finished from the solid, two rows of holes for stop-pins and a movement of 6 ft. 9 in. on the bed. Quick power movement, with automatic stop, from 9 to 26½ ft. per minute in either direction is provided. The feeds are arranged to maintain any desired rate at any spindle speed. The table is operated by a screw in a revolving bronze nut, and the thrust is taken by ball bearings.

The feeds for the table are positive in either direction, by means of gearing in a feed-box conveniently located, and the change from one rate to another is quickly obtained. There are nine changes ranging from 1 in. to 8½ in. per minute at any spindle speed.

The spindle is of crucible steel and runs in boxes of hard bronze. It has a tapered end 3 in. in diameter for face milling cutters, and a No. 11 Brown & Sharpe taper hole for cutter shanks and arbors. It has a 6-in. independent adjustment and a horizontal movement of 22 in. on the overhanging arm. Through the center of the spindle is a hole for the retaining bolt.

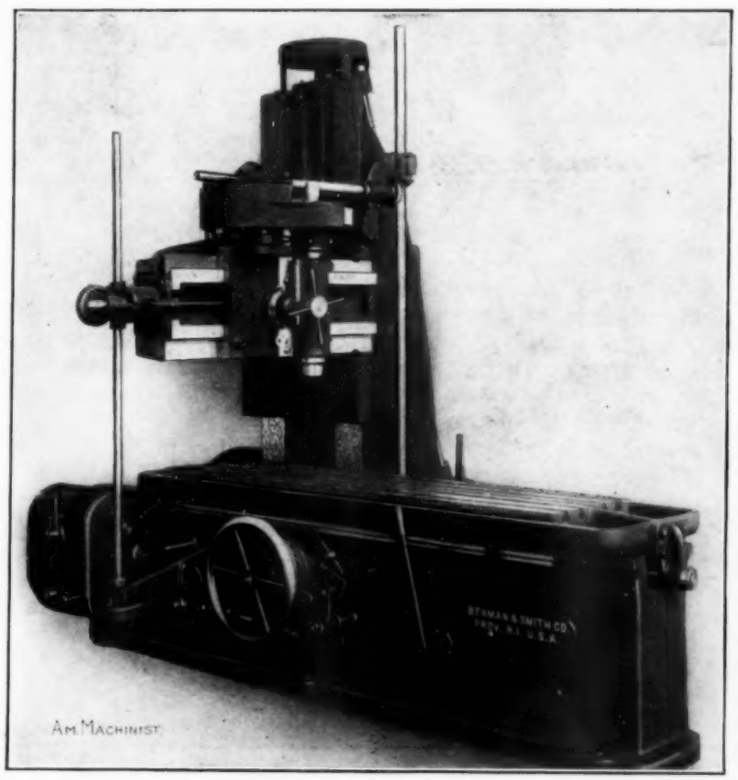
The front bearing is 3¼ in. in diameter, 4½ in. long and means are provided to compensate for wear. The rear bearing is 2⅞ in. in diameter and 4½ in. long. Gearing, in the ratios of 3⅕ and 10½ to 1, provides eight spindle speeds from 14½ to 140 r.p.m.

The crossrail has a vertical power movement, for adjustment on the upright, from 11 to 32 in. per minute. The spindle saddle has a crossfeed of 22 in. The table is 18 in. wide and 6 ft. long; and has a feed and quick power movement of 6 ft. 9 in. The distance from the end of the spindle to the top of the table is 0 to 36 in. The countershaft has tight and loose pulleys 14 in. in diameter for 5-in. belt to run 265 r.p.m. The weight is approximately 13,000 lb.

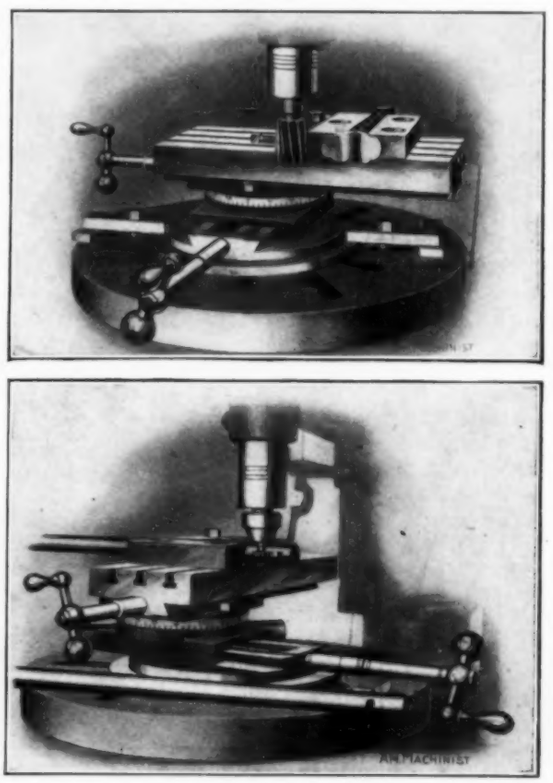
This machine is a recent design of the Beaman & Smith Co., Providence, R. I.

Milling Attachment and Compound Table

The design and construction of this attachment is apparent from the illustrations.



VERTICAL-SPINDLE MILLER



MILLING ATTACHMENT AND COMPOUND TABLE

It is intended to be attached to any upright drilling machine from 14 to 42 in. swing.

The bearings are scraped, and the screws run in bronze nuts. The attachment is furnished with a substantial vise for holding the work.

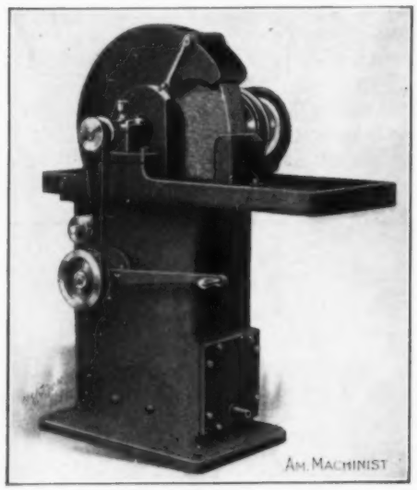
The upper illustration shows the attachment at work facing off ends of connecting rods while the lower one shows it cutting Woodruff keyseats in automobile axles.

This attachment is a recent product of the Hinckley Machine Works, Hinckley, Ill.

A Water Tool Grinder

The tool grinder shown in the halftone is built in three sizes by the Northampton Emery Wheel Co., Leeds, Mass. These machines carry wheels 16, 20 and 24 inches diameter respectively.

The base of the machine forms a tank for the water. Mounted on the end of the main spindle is a flanged pulley which by means of a belt drives another flanged pulley mounted on a shaft which extends into the base above the water. On this shaft is another flanged pulley on which runs an endless chain the lower



A WATER TOOL GRINDER

part of which is immersed in the water. As this chain runs it carries a certain amount of water which is thrown by centrifugal force against the abrasive wheel. The lever at the left of the machine controls the belt tightening idler and incidentally the quantity of water delivered to the wheel.

The plate at the front can be removed when it becomes necessary to clean the tank.

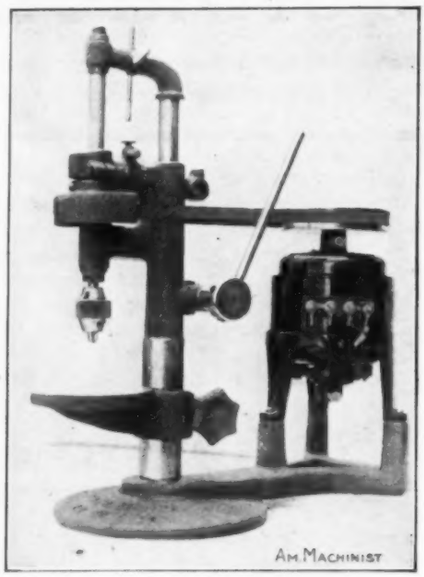
Sensitive Drilling Machine

The halftone shows one of a line of motor-driven sensitive drilling machines recently developed by the Langelier Manufacturing Co., Providence, R. I. These machines are made in both bench and stand types.

The spindle floats inside a sleeve continuous through the two spindle bearings, and the driving pulley is keyed to the sleeve. By this arrangement belt pull on the spindle is practically eliminated. There is a belt guard over the spindle pulley.

The feeding of the spindle of either the bench or stand types may be done by means of the hand lever at the side of the column, or by a foot treadle with the rod through the inside of the column.

The table has a vertical adjustment of 4⅝ in. It can be swung to the side if desired. For drilling to accurate depths a vertical gage rod, seen through the spindle frame, is set to the distance and changed by a wing nut. The lower end of the rod strikes on a hardened fine-pitch, knurled screw by means of which



SENSITIVE DRILLING MACHINE

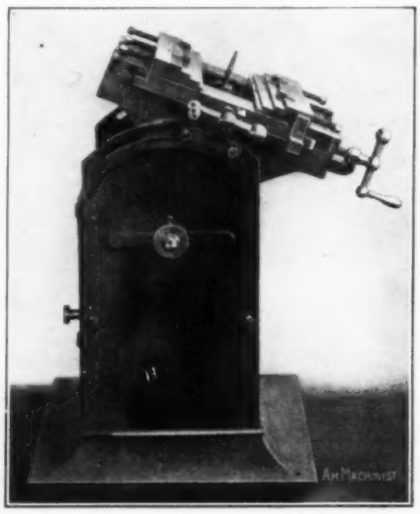
minute settings may be made. A binding screw at the side fixes the vertical screw at the height wanted.

The bench and stand types weigh, with motor, 50 and 100 lb., respectively.

A Die Miller

The halftone shows a die miller, built by the Harrington Machine Co., Erie, Penn.

The spindle of the machine is at right angles to the table, to which the work is attached. The desired clearance on the



A DIE MILLER

work is secured by using angular mills of the correct taper. The work is secured to the table with the marked side up, so that the operator can readily see the line he is to follow.

The table, work and cutter can be tilted to an angle either to the right or left to suit the light or the convenience of the operator. The machine weighs 1250 lb., and occupies floor space of 27x25½ inches.

A Combined Thrust and Radial Ball Bearing

The line engraving shows a section of a combined radial and thrust ball bearing manufactured by the Société de Mécanique de Précision of Clichy, France and handled in this country by the Globe Ball Bearing Co., 50 Church Street, New York, N. Y.

COMBINATION BEARING

German Metal-Working Machinery Exports

German metal-working machinery exports in 1911 were more in volume and less in value than in 1910, as shown by the following table.

WEIGHT

	Double centners	Tons (2000 lb.)
1907	452,647	99,600
1908	459,673	101,120
1909	365,102	80,320
1910	447,037	98,350
1911	550,715	121,157

VALUE

	Marks	Dollars
1907	65,738,000	16,434,500
1908	67,502,000	16,900,000
1909	50,345,000	12,587,250
1910	65,991,000	15,247,750
1911	60,276,000	15,069,000

Taking the ratios of quantity and value it appears that the machinery exported in 1911 averaged only 109.5 marks per double centner, against 147.0 marks in 1908. The distribution of exports of this class of machinery among chief countries in double centners (440 lb.) was as follows:

	1907	1911
Italy	104,748	87,884
Austria Hungary	65,262	90,177
France	63,851	63,697
Switzerland	35,847	25,226
Great Britain	28,750	17,455
Belgium	25,485	33,954
Russia	22,190	62,601
Argentina	9,233	15,956

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

For the convenience of readers, news items in this department are arranged geographically, by states. The various states will be grouped under subheads, as follows:

New England: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut.

Middle Atlantic: New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia.

Southern: Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Tennessee, Kentucky.

Middle West: Ohio, Indiana, Michigan, Illinois, Wisconsin.

West of the Mississippi: Iowa, Minnesota, Kansas, Nebraska, South Dakota, North Dakota, Wyoming, Colorado, Montana, Missouri, Arkansas, Texas, Oklahoma, New Mexico.

Western States: Idaho, Utah, Nevada, Arizona, Washington, Oregon, California.

Metal Working

NEW ENGLAND STATES

The roundhouse of the Boston & Maine R.R. at Manchester, N. H., was destroyed by fire, May 12. Loss, $125,000.

The Oldsmobile Co., of Boston, Mass., will erect a four-story garage, salesrooms and repair shop, at Commonwealth and Hillsdale Ave.

A four-story reinforced-concrete garage, 65x100 ft., is to be erected on Cummington St., Boston, Mass., for Carrie L. Burton. The estimated cost is $50,000. Somes & Parsons, 101 Tremont St., are the architects.

The Springfield Street Ry. Co., of Springfield, Mass., will build a new repair shop.

The Van Norman Machine Tool Co. has purchased the business and property of the Waltham Watch Tool Co., at Springfield, Mass., and will greatly increase the output of the plant. Frank E. Page is president.

The Arcade Malleable Iron Co., Albany St., Worcester, Mass., has let the contract for the erection of a new foundry. The building will be of wood and brick, 70x102 ft., one-story high, with slate roof.

The Sterling Vacuum Cleaner Co., Worcester, Mass., has been organized to manufacture a new vacuum cleaner. A new factory will be built. F. H. Fisher, Hartford, Conn., is president.

Work has been started on a new addition to the factory of the Bryant Electric Co., of Bridgeport, Conn. The addition will be 69x143 ft., of brick.

Whipple & Choate, manufacturers of metals, Bridgeport, Conn., is having plans prepared by A. S. Meloy, architect, for the construction of a new factory. It will be 45x120 ft., two stories high, of brick and steel.

The engine, machine and sand houses at the brickyard of J. C. L. Lincoln, Newfield, Conn., were destroyed by fire, May 13. Loss, $6000, partly covered by insurance.

The French Mfg. Co., manufacturers of brass and copper tubing, Waterbury, Conn., have awarded the contract for the erection of a new factory, at Robbins St. and Grandview Ave. It will be 40x100 ft., two stories high, of brick. E. E. Benedict is the architect. Noted Apr. 11.

The Waterbury Metal Co., Waterbury, Conn., will occupy the entire building in which it is now located, and increase its capacity.

MIDDLE ATLANTIC

The machine shops of Clark Bros. Co., manufacturer of engines, sawmill machinery and electric-light apparatus, Belmont, N. Y., were destroyed by fire, May 11. Loss, $200,000.

Plans have been filed for the erection of an eight-story factory, 100x66 ft., on Park Ave., between Ryerson and Hall Sts., Brooklyn, N. Y., for the Mergenthaler Linotype Co. It will be of brick. The estimated cost is $100,000.

The W. Robertson Machine & Foundry Co., 32 Greenwood Place, Buffalo, N. Y., has been organized and will equip a plant for the manufacture of machine tool specialties. W. Robertson is president and manager.

The Lumen Bearing Co., Buffalo, N. Y., has completed plans for the construction of an addition to its plant, at Sycamore and Lathrop Sts.

The Gasoline Motor Co., 1280 Niagara St., Buffalo, N. Y., will build an addition to its plant, to cost about $40,000.

John H. Maybee, Canton, N. Y., has begun work on the foundation for a 40x100-ft., two-story concrete-block garage on Main St. The new building will accommodate about 50 cars.

The plant of the Phoenix Hardware Mfg. Co., at Homer, N. Y., was damaged by fire, May 10. Loss, $100,000.

The motorcycle shop of J. C. Foley, Jerome Ave., near One Hundred and Sixty-fourth St., New York, N. Y., was damaged by fire, May 12. Loss, $5000.

The Xargil Kerosene Engine Co., Utica, N. Y., recently incorporated with a capital of $100,000, will build a plant for the manufacture of motors, machinery and engines. J. A. Xargil and B. F. Gilbert are interested.

Plans have been completed and the contract is about to be awarded for the construction of a three-story and basement addition, 117x54 ft., to the plant of the Savage Arms Works, Utica, N. Y. R. A. George is the architect.

The Bergdoll Machine Co., manufacturers of automobile parts, Trenton Junction, N. J., has purchased additional property and will erect a new factory.

D. G. Pfoutz, manager of the Chambersburg Automobile Co., of Chambersburg, Penn., will remodel, for garage purposes, one of the large foundry buildings on King St., which he recently purchased.

W. Murray Carr, of the Franklin Motor Car Co., Pittsburg, Penn., has arranged for the construction of a three-story garage and salesroom on North Craig St.

The Tabernacle Presbyterian Church, of Pittsburg, Penn., has awarded the contract to erect a two-story garage, to cost about $30,000.

The Pullman Automobile Co., Pittsburg, Penn., has awarded a contract at $11,000, for the erection of a garage, at Highland Ave. and Ravine St.

The Pennsylvania Flexible Metallic Tubing Co., Seventy-second and Powers Sts., Philadelphia, Penn., has purchased a tract of 6½ acres, at Suffolk and Lyons Aves., and will erect a plant.

Felix McCarthy, 117 North Hanover St., Pottstown, Penn., has purchased the old Pottstown pumping station, and will convert it into a foundry and machine shop, purchasing all new equipment.

The Harlan & Hollingsworth Corporation, builders of steel ships and cars, Wilmington, Del., has taken out permits for the construction of new car shops estimated to cost $216,000. The two new shops will be 222x359 ft., two stories high, of brick and steel.

The Eastern Auto & Supply Co. has secured a permit for the erection of a modern public garage at Philadelphia Ave. and Curley St., East Baltimore, Md. The plans call for a 48x180-ft. one-story building, constructed of brick and stone. The estimated cost is $8500.

Bids are asked as follows until 10 a.m., June 4, by the Paymaster-General, U. S. N., Chief of the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing the following materials: Schedule 4556, Class 131, for delivery at the Navy Yards at Boston, Philadelphia and Brooklyn, wrought-iron bars in commercial lengths; Class 132, for delivery at the Navy Yards at Portsmouth, Boston, Brooklyn and Norfolk, steel bolts and nuts, with hexagon heads and nuts; Class 133, for delivery at Portsmouth, Boston, Brooklyn, Philadelphia and Norfolk Navy Yards, plate washers, wrought-iron or steel, black; Class 134, for delivery at Brooklyn Navy Yard, steel stove bolts with nuts; Class 135, for delivery at Brooklyn Navy Yard, steel hull rivets; the quantity on each class is large. Schedule 4557, Class 137, for delivery at Norfolk Navy Yard, high tensile nickel-steel bar; Class 138, for delivery at Brooklyn and Philadelphia Navy Yards, bar steel and nickel steel, Class A; Class 139, for delivery at Brooklyn, Philadelphia and Charleston Navy Yards, bar steel, Class B, round, square and hexagonal; Class 140, for delivery at Brooklyn Navy Yard, bar steel, Class B, square; Class 141, for delivery at Portsmouth, Boston, Brooklyn and Charleston Navy Yards, medium bar steel and rivet steel in commercial lengths; Class 143, for delivery at Boston, Brooklyn and Philadelphia Navy Yards, cold-rolled steel, round; Class 144, for delivery at Portsmouth, Boston, Brooklyn, Philadelphia, Norfolk and Charleston Navy Yards, medium steel angles, channel bars, shapes and I-beams; Class 147, for delivery at Portsmouth, Boston, Brooklyn and Norfolk Navy Yards, medium steel plates; Class 148, for delivery at same yards, medium steel plates; Class 149, for delivery at same yards, medium steel plates; Class 151, for delivery at Portsmouth, Boston, Brooklyn, Philadelphia, Norfolk and Charleston Navy Yards, galvanized sheet steel; Class 152, for delivery at Brooklyn Navy Yard, medium bar steel; the quantities on each of the above classes are large. Other classes of the schedule call for smaller quantities of galvanized bar steel, medium steel bulb angles, medium steel half-round bars and medium steel plates. Schedule 4558, Class 161, for delivery at Portsmouth, Boston, Brooklyn, Philadelphia, Norfolk and Charleston Navy Yards, wrought-iron pipe, galvanized and black; Class 162, for delivery at Portsmouth, Brooklyn, Philadelphia and Norfolk Navy Yards, unions, cast iron and malleable; Class 163, for delivery at Boston, Brooklyn, Philadelphia and Norfolk, pipe fittings; the quantities on each of the above classes are large.

SOUTHERN STATES

The main foundry building of the R. W. Whitehurst Co., manufacturer of agricultural implements, Norfolk, Va., was destroyed by fire, May 11. Loss, $125,000, partly covered by insurance.

The Chattanooga Iron & Coal Co., Chattanooga, Tenn., will spend several hundred thousand dollars for improvements and machinery. A new plant to cost $75,000 is under consideration. Alexander W. Chambliss is in charge.

The Virginia Bridge & Iron Co., Roanoke, Va., has announced plans for the construction of an addition to its plant at Memphis, Tenn. The cost of the building and equipment, which will consist of shearing and riveting equipment, will be $50,000.

The Florida Metal Products Co., Jacksonville, Fla., will erect a building in the near future.

The R. E. Harryman Machine Co., Louisville, Ky., has doubled its floor space and is considering adding additional equipment, including a drill press, punch press, etc. The equipment will probably be motor driven.

H. L. Pittmann, Pineville, Ky., will erect a plant in the fall to manufacture motor driven sewing machines.

MIDDLE WEST

The Craig Foundry Co., Bucyrus, Ohio, is erecting an addition.

The Ohio Blower Co., Cleveland, Ohio, is erecting a new shop.

The Cleveland Metal Treating Co., Cleveland, Ohio, is building a new factory.

A garage will be built by the Cuyahoga Telephone Co., at Cleveland, Ohio.

A garage will be built by the Garage Co., at West 25th St., Cleveland, Ohio.

The Cleveland Foundry Co., Cleveland, Ohio, is building a $5000 addition to its factory.

The American Steel & Wire Co., Cleveland, Ohio, manufacturer of steel and wire, is building an addition to its factory.

The Cuyahoga Telephone Co., Cleveland, Ohio, will erect a garage, to cost $5000, at 643 Huron Road.

The Kurtzner Radiator Co., Cleveland, Ohio, has doubled its capital and will add equipment to its foundry and shops.

The Electrical Novelty Co., Cleveland, Ohio, will equip a factory to make electrical novelties. T. J. Sheftall is the manager.

The W. S. Tyler Wire Co., Cleveland, Ohio, has let the contract for a new addition, 189x100 ft., to its plant to manufacture wire and metal goods.

The Interstate Iron Foundry Co., Cleveland, Ohio, will build an addition to its present plant.

The plant of the Prest-O-Light Co., Cincinnati, Ohio, maker of Prest-O-Light gas tanks for automobiles, was destroyed by an explosion.

The Nimmo Fence Co., manufacturer of wire and iron fences, Cincinnati, Ohio, has purchased a site of two acres on 34th Ave. and the B. & O. S. W. R.R. tracks, and will erect a two-story factory, 90x140 ft. The estimated cost is $45,000.

The Dayton Dental Supply Mfg. Co., Dayton, Ohio, has doubled its capital and will add some light machinery to its factory equipment.

The Bishop Gearing Wrench & Mfg. Co., Findlay, Ohio, will equip a new machine shop. G. R. Thompson is in charge.

A garage will be fully equipped by the Ideal Garage Co., Mansfield, Ohio.

The Heer Engine Co., Portsmouth, Ohio, has raised its capital to $250,000. Considerable new machinery will be added to its factory.

A garage will be built by the Gem Garage Co., Springfield, Ohio.

Fire destroyed part of the plant of the Sandusky Foundry & Machine Co., Sandusky, Ohio.

The Roller Bearing Co. will erect a large factory at Sandusky.

The General Steel Products Co., manufacturer of automobile parts, Toledo, Ohio, is erecting a new $25,000 plant.

The Toledo Metal Hub Co., Toledo, Ohio, recently incorporated, will construct a factory to manufacture metal wheel hubs.

The Toledo Water Power Vacuum Cleaner Co., Toledo, Ohio, contemplate the erection of a factory.

The Disco Auto Starter Co., Toledo, Ohio, will equip a factory to make a new automobile starter. H. A. Cavanagh is the manager.

The Zoar Battery Co., Zoar, Ohio, maker of electrical batteries, has doubled its capital and will make improvements.

The Hubbard Steel Foundry Co., East Chicago, Ind., will erect a foundry, 160x165 ft.

Ferdinand Schleschinger, Milwaukee, Wis., and associates have purchased a site of 415 acres within the limits of Hammond, Ind., and will construct a steel plant. The estimated cost is $11,000,000.

A new automobile factory is being erected in Indianapolis, Ind., for the manufacture of pleasure automobiles. It will be known as the Henderson Motor Car Co.

Frederick Feinberg and Daniel Seller have closed a ten-year lease on the Barney property at Main and Catherine Sts., Ann Arbor, Mich., and after remodeling the building and installing machinery and other appurtenances, will use it as a garage.

The Long Mfg. Co., manufacturer of automobile radiators, Detroit, Mich., has sold its present plant and will at once begin the erection of a new plant.

The Triumph Mfg. Co., maker of motorcycles, Detroit, Mich., is erecting a new factory and new equipment will be needed.

The Nolsenne Supply Co., manufacturer of automobile parts, Detroit, Mich., was partly destroyed by fire.

The Federal Motor Truck Co., Detroit, Mich., manufacturer of motor trucks, has purchased the buildings formerly occupied by the Van Dyke Motor Car Co., on Leavitt Ave. New equipment will be needed.

The Cadillac Motor Car Co., Detroit, Mich., manufacturer of automobiles, has purchased from the Long Nyes Co., a new factory building for increased manufacturing facilities. New equipment will be needed.

Fire completely destroyed the plants of the Wolverine Motor Casting Co., Wolverine Motor Supply Co. and Wayne Shoe Co., at 210 Catherine St., Detroit, Mich., on May 8. Loss, $10,500.

Frank C. Root, formerly of the Aluminum Castings Co., is erecting a new factory for the manufacture of aluminum castings, at East Grand Boulevard and St. Aubin Ave., Detroit, Mich.

The Abbott Motor Co., manufacturer of automobiles, Detroit, Mich., is building an addition to its factory.

The Kalamazoo Buggy Co., Kalamazoo, Mich., is planning to enlarge its automobile plant.

The Original Gas Engine Co., Lansing, Mich., will erect a two-story brick factory building, 125x300 ft.

The Olds Motor Works, Lansing, Mich., has awarded the contract for the erection of a four-story office, salesroom and service building.

The Dudly Tool Co., Menominee, Mich., manufacturer of wrenches, etc., is erecting an addition, 40x60 ft.

The car shops of the Illinois Terminal R.R. Co., Alton, Ill., were damaged by fire, at a loss of $50,000, May 3.

The Home Stove Works, Chicago, Ill., will build a two-story brick foundry, at 2611-45 West 18th St., to cost $60,000. F. E. Davidson is the architect.

The People's Gas Light & Coke Co., Chicago, Ill., will build a $12,000 brick repair shop, at 1119-31 Hawthorne Ave. K. Schenk is the architect. New machinery will be required.

The George D. Whitcomb Mining Machinery Co., Rochelle, Ill., will erect a new shop.

The Beaver Dam Malleable Iron Range Co., Beaver Dam, Wis., has awarded the contract for the construction of four large additions to its factory to cost $50,000.

The Tomahawk Steel & Iron Co., Tomahawk, Wis., is having plans prepared for a new factory, 100x120 ft. The estimated cost is $40,000. J. F. Callan is the secretary.

WEST OF THE MISSISSIPPI

The Marshalltown Trowel Co., Marshalltown, Iowa, manufacturer of trowels, will build a new blacksmith shop. The estimated cost is $8000.

The Colby Motor Co., Mason City, Iowa, is building a new factory, 100x400 ft.

The C. A. Dunham Co., Marshalltown, Iowa, manufacturer of steam traps, will add two new buildings to its plant. The estimated cost is $10,000.

The Oakland Auto Co., Oakland, Neb., has started the erection of a new garage. It will be constructed of cement blocks.

The Omaha Auto Co., Omaha, Neb., is erecting a large fireproof iron garage, at the rear of its new quarters at 2010 Farnam St.

Smith & Tetrault, of Walhalla, N. D., have started work on their new garage, at Central and Twelfth Sts. A complete modern repair shop will be installed.

The Colorado & Southern R.R. Co. is planning the construction of a roundhouse and shops, at Hartville, Wyo.

WESTERN STATES

The Mack Auto Co., Reno, Nev., will enlarge its comercial garage.

The L. D. McCarthy Automobile Co., Spokane, Wash., has completed plans for the erection of a one-story addition to its garage. The estimated cost is $8000.

The Lewis & Clark Steel Co., Tacoma, Wash., has been incorporated with a capital of $5,000,000, by M. E. Gunston, W. R. Flaskett and L. W. Heath. The company will erect a large steel plant, on Chambers Creek, near Tacoma.

The Ideal Pump Co., 1912 Westlake Ave., Seattle, Wash., manufacturer of rotary pumps, is planning to increase the capacity of its factory. James C. Langley is manager.

Emerick Bros. and S. Childers have completed plans for the construction of a brick garage, 70x75 ft., on South Bartlett St., Medford, Ore. It will have a concrete foundation and brick wall of sufficient strength to carry three stories, one of which will be built at present.

Hardin & Richmond, Portland, Ore., will erect a commercial garage and machine shop. The estimated cost is $12,500.

The Portland Sheet Metal Works, East Seventh and Madison Sts., Portland, Ore., is planning the erection of a reinforced-concrete shop, 100x150, at Twenty-third and Holgate Aves.

The Anaheim Motor Co., Anaheim, Calif., will erect a new commercial garage and machine shop. The estimated cost is $6000.

Hawley, King & Co., Los Angeles, Calif., will erect a commercial garage and repair plant, on South Olive St. Noonan & Kysor, Wright & Callender Building, Los Angeles, are the architects.

CANADA

The McDonald Thresher Co., Stratford, Ont., will build a large addition to its plant. The estimated cost is $60,000.

The Victoria Stove Co., Napierville, Que., will erect a factory, at a cost of $25,000.

The Electrical Specialties Co., New Hamburg, Ont., will erect a new factory at a cost of $25,000. W. Fowler is manager.

The Manitoba Bridge & Iron Works, Ltd., has secured an option on 30 acres of land in North Transcona, Man., as a site for a steel plant. The estimated cost of the plant is $1,000,000.

The Eureka Planter Co., Woodstock, Ont., manufacturer of various farming implements, is planning to install a plant at Bashaw, Alta.

The German Scientific Machinery Co., New Westminster, B. C., is contemplating the construction of a plant with a capacity of 48,000 brick daily. The estimated cost is $80,000.

NEW INCORPORATIONS

METAL WORKING

The following companies have been incorporated to manufacture:

The International Stamp & Ticket Machine Co., Kittery, Maine; capital, $400,000. Incorporators, Horace Mitchell and C. E. Smothers, both of Kittery.

The Forest City Automobile Co., Portland, Maine; automobiles and motor carriages. Capital, $10,000. J. A. Clarke is president and W. B. Clarke is treasurer.

The Presto Inner-Rim Co., Portland, Maine; automobiles, wheels and rims. Capital, $200,000. M. A. Thurston, Portland, is president, and H. P. Sweetsir, treasurer.

The Van Norman Machine Tool Co., Springfield, Mass.; machine tools. Capital, $400,000. Incorporators: Frank H. Page, Clarence J. Wetsel and Charles D. VanNorman.

The Sterling Vacuum Cleaner Co., Worcester, Mass.; vacuum cleaners. Capital, $15,000. Incorporators: Frederick H. Fisher, Olaf G. Hedlund and Eric G. Thorem.

The W. Robertson Foundry & Machine Co., Buffalo, N. Y.; machine shop and foundry. Capital, $15,000. Incorporators, William Robertson, 32 Greenwood Place; Frank H. Keil, Hunt Ave., Buffalo, and Thomas J. Reed, Wilkes-Barre, Penn.

The Julius Wagner Machine Works, Inc. (Astoria Sta.), L. I. City, N. Y.; machinery. Capital, $25,000. Incorporators: J. Gasteiner, Astoria; H. A. Kretschmer, Corona, L. I., and B. Cowen, New York, N. Y.

The American Lock Co., Boro. Manhattan, N. Y.; locks and hardware specialties. Capital, $50,000. Incorporators: T. English, F. Groat and S. Sladden, New York, N. Y.

The Suburban Equipment Co., Boro. Manhattan, N. Y.; machinery and motors. Capital, $10,000. Incorporators, Harrison O. Otis, 2 Rector St.; Charles A. Parker, 702 Monroe St., Brooklyn, and Wendell B. Barker, 100 William St., New York, N. Y.

The Finkelstein Electric Co., Inc., Boro. Manhattan, N. Y.; electric supplies. Capital, $5000. Incorporators, Morris F. Finkelstein, 740 Kelley St., Bronx, N. Y.; Meyer Bank, 116 East One Hundred and Fourteenth St., New York, N. Y., and Max Goldberg, 12 Willett St., New York, N. Y.

The National Bottle Filler Machine Co., Boro. Manhattan, N. Y.; machines for filling bottles. Capital, $15,000. Incorporators, Bernard Schwartz, 756 Woodward Ave., Ridgewood, N. J.; Herman M. Silverman, 457 Van Buren St., and Michael L. Silverman, 112 Ralph St., Brooklyn, N. Y.

The Green-Matthews-Taylor Co., Boro. Manhattan, N. Y.; concrete mixing machines. Incorporators, Ollie A. Green, 1217 Hoe Ave., Chester E. Matthews, 305 East One Hundred and Forty-second St.; Samuel A. Taylor, ???? Powell Ave., New York, N. Y.

The Diamond Motor Car Co., Pelham Manor, N. Y.; motor vehicles. Capital, $10,000. Incorporators: Carl W. Runlett, Pelham Manor; Charles W. Jaycox, Sycamore Park, New Rochelle, and Frank Davis, 46 Diwanoy Ave., New Rochelle, N. Y.

The American Shut Off Valve Co., Camden, N. J.; gas, steam or electric valves. Capital, $100,000. Incorporators: P. P. Menard, G. L. Burlingame and A. Agerbach, Camden.

The Eastern Motor Racing Association, East Orange, N. J.; motor cycles and automobiles. Capital, $50,000. Incorporators: H. H. Picking, C. O. Geyer and F. E. Ruggles.

The Richmond Metal Bed Co., Richmond, Va.; metal beds. Capital, $50,000. Incorporators, J. W. Baum, New York, N. Y.; F. S. Bullington and S. Bowman, both of Richmond.

The Memphis Nut, Lock & Bolt Mfg. Co., Memphis, Tenn. Capital, $500,000. Incorporators, W. T. Peter, G. D. Siler and H. W. German.

The West Hill Garage Co., Akron, Ohio; garage and repair shop. Capital, $12,000. Incorporators: Samuel A. Kepler, Arthur O. Wood and Mary F. Stouffer.

The Jansen-Peterson Co., Cleveland, Ohio; belt banding, woodworking and other machinery. Capital, $100,000. Incorporated by N. C. Bruce and E. M. Jansen.

The Eureka Electric Co., Cleveland, Ohio; electric machinery, appliances and equipment. Capital, $15,000. Incorporators: A. S. Dole, H. M. Coyne and Samuel Lazarus.

The West Twenty-fifth Supply & Garage Co., Cleveland, Ohio; garage. Capital, $10,000. Incorporators: Henry W. Louis, F. M. Brady and Katherine Louis.

The Ohio Motor Sales Co., Cincinnati, Ohio; automobiles. Capital, $100,000. Incorporators, C. F. Pratt, A. E. Schaefer and H. T. Boulden.

The Standard Register Co., Dayton, Ohio; autographic registers. Capital, $100,000. Incorporators: John C. Shea, W. S. McConnaughey and T. F. Shiemer.

The W. H. Hartley Sons Co., Quaker City, Ohio; hardware, vehicles and implements. Capital, $25,000. Incorporators: Milton L. Hartley, H. S. Hartley and O. G. Hartley.

The Disco Auto Starter Co., Toledo, Ohio; automobiles and automobile parts. Capital, $10,000. Incorporators: H. A. Cavanagh, R. S. Holbrook and C. R. Banker.

The Swedish Vibrator Co., Chicago, Ill.; electrical machines and appliances. Capital, $10,000. Incorporators: C. G. Groff, George C. Aldrich and B. M. Patterson.

The Hydro Electric Co., Chicago, Ill.; electrical appliances. Capital, $2000. Incorporators: I. S. Blumenthal, Maurice Alschuler and C. C. Brosius.

The Western Hardware Mfg. Co., Chicago, Ill.; metal goods. Capital, $5000. Incorporators: O. S. Baylies, Alanson C. Noble and Joseph J. Guler.

The Smith & Phillips Mfg. Co., Chicago, Ill.; machinery. Capital, $5000. Incorporators, C. V. McCullough, Mark L. Smith and William A. Conover, Rector Building, Chicago, Ill.

The Kimmel Furnace Co., Kansas City, Mo.; steel furnaces. Capital, $50,000. Incorporators, J. C. Kimmel, M. S. Kimmel and F. E. McCurdy.

General Manufacturing

NEW ENGLAND STATES

The shop of Henry E. Davis, manufacturer of carriages and sleighs, Ellsworth, Maine, was totally destroyed by fire.

The city of Acton, Mass., will build a new pumping station.

Fire damaged the building of the Boston Batting Co., 1207 Dorchester Ave., Boston, Mass., May 8. Loss, $500.

The Boston Cold Storage & Terminal Co. will build a new eight-story building at its plant in East Boston, Mass.

Stone & Forsyth Co., paper manufacturer, will build a new factory, at Everett, Mass.

The Fitchburg Paper Co., River St., Fitchburg, Mass., has awarded the contract for the construction of an addition to its factory. It will be two stories high, 57x57 ft., of brick. Noted Apr. 4.

The water commissioners of Gardner, Mass., will erect a large addition to the pumping plant for its water system.

Fire caused $12,000 damage to the textile plant of the Jefferson Mfg. Co., Holden, Mass.

Fire caused over $5000 damage to the plant of the Monument Mills, manufacturers of cotton cloth, Housatonic, Mass.

The D. B. Rising Paper Co., Housatonic, Mass., has awarded the contract for the construction of an addition to its plant. It will be 40x60 ft., one story high, of brick. George F. Hardy, 309 Broadway, New York, N. Y., is the architect.

The Stansfield Felting Co., Inc., was recently organized in Boston and has taken over the Buffunville Mills at Oxford, Mass., and will install new and improved machinery. Robt. G. Dodge is president.

The granite polishing plant of Thomas Mitchell, at Center and Columbia Sts., Quincy, Mass., was destroyed by fire, May 12. Loss, $8000.

The city of South Egremont, Mass., will install a new water system.

The Fiberloid Co., of Indian Orchard, Mass., has had plans drawn for a two-story addition to its factory, 168x58 ft., of brick, with concrete foundations. The cost is $50,000.

The Uxbridge Worsted Co., Uxbridge, Mass., will construct a new brick dyehouse, 40x100 ft. C. A. Root is manager.

The Wakefield Mills Co., Wakefield, Mass., is contemplating the erection of a new weave mill.

The building at 536 Atwells Ave., Providence, R. I., was destroyed by fire, on May 7. It was occupied by the Monahan Vehicle Co., and the Revere Rubber Co. The loss is $500,000.

The shoe blacking factory of Everett & Barron, 217 Canal St., Providence, R. I., was damaged by fire, May 10. Loss, $16,000.

The C. G. Armstrong Mfg. Co., of Meriden, Conn., has been organized to manufacture jewelry, and will erect a factory.

MIDDLE ATLANTIC STATES

The Rural Knitting Mill, Amsterdam, N. Y., is preparing plans for the erection of a yarn mill.

The Law & Wilbur Co. has been incorporated and will build and equip a flour mill, at Collins, N. Y. Benedict Law, of Collins, is an incorporator.

The A. N. Russell & Sons Co., manufacturer of furniture, Ilion, N. Y., has increased its capital and will erect a new three-story brick factory, 66x75 ft., and a one-story extension, 30x40 ft.

Fire did $3000 damage to the Foote Avenue Feed Mills, owned by Anderson & Weborg, at Jamestown, N. Y.

The sawmill of J. D. Hall, 2 Tomkins St., New York, N. Y., was burned, May 13. Loss, $25,000, covered by insurance.

The ground floor of the building at 535 Broadway, New York, N. Y., occupied by M. H. Stein, manufacturer of cigars, was damaged by fire, May 11. Loss, $500.

The eighth floor of the building at 34 West Houston St., New York, N. Y., occupied by the Metropolitan Tayloring Co., was damaged by fire, May 10. Loss, $1500.

The Board of Estimate, New York, N. Y., has ordered plans prepared for the construction of a refuse destructor and section house at Ridgewood (L. I.), N. Y. The estimated cost is $185,000.

The Newel Mfg. Co., Ogdensburg, N. Y., will erect a new factory.

The Will & Baumer Co., Syracuse, N. Y., is contemplating the installation of machinery for the manufacture of dynamite and chemically pure glycerin.

The Chemic-Alloy Co., Bradford, Penn., is contemplating the erection of a factory in Syracuse N. Y.

The Aetna Realty Co., 738 Broad St., Newark, N. J., will soon begin the construction of a one-story brick factory, at 249 South St., which will be occupied by the Sterling Waxed Paper Mfg. Co. The building will be 60x200 ft., and cost $20,000.

Weingarten Bros., manufacturers of corsets, 405 High St., Newark, N. J., will erect two new factory buildings, costing $60,000. They will be of brick, 45x82 ft., and 63x154 ft. Noted May 2.

The contract for the construction of a sewage disposal plant at the Pennsylvania State Sanatorium for Tuberculosis, at Cresson, Penn., has been awarded.

The Gibboney Planing Mill, Everett, Penn., was destroyed by fire, May 3. The mill will be rebuilt.

The Conklin Engineering Co. has completed the designs for the construction of a reinforced-concrete factory, for the Peerless Silk Hosiery Co., at Kensington, Penn.

H. S. White, New Kensington, Penn., has purchased land near Tarentum, Penn., and will build a plant for the manufacture of bricks.

The Pennsylvania Soap Co., Lancaster, Penn., will install machinery for the purpose of recovering glycerin from spent soap lyes.

The Russell Box & Lumber Co., McKees Rocks, Penn., is receiving bids for the construction of a factory.

The Phoenix Glass Co., Monaca, Penn., which also has a plant at Washington, Penn., has completed plans for uniting its factories under one roof in Monaca. A new plant, to cost about $200,000, will be constructed and the present building will be improved and enlarged.

The McDowell Mfg. Co., Millvale, Penn., manufacturer of wall ties, is increasing the capacity of its plant and adding new machinery.

It is reported that Liebovitz Bros. will construct a shirt factory, in Pottstown, Penn., to cost about $60,000.

The printing plant of Stuart Bros., 412 Market St., Philadelphia, Penn., was destroyed by fire, May 10. Loss, $100,000.

The factory of the Woods-Lloyd Co., manufacturer of glass house supplies, South 30th and Jane Sts., Pittsburg, Penn., was damaged by fire, May 12. Loss, $50,000, covered by insurance.

The factory of the Pennsylvania Macaroni Co., Main and 12th Sts., Sharpsburg, Penn., was burned, May 11. Loss, $8000, covered by insurance.

The contract for the construction of a two-story addition, 75x120 ft., to the plant of the Standard Brewing Co., Scranton, Penn., has been awarded. It will be of brick, concrete and steel. Bollinger Bros., Fulton Building, Pittsburg, are the architects.

The Philadelphia Electric Co., Tenth and Chestnut Sts., Philadelphia, Penn., has awarded the contract for the construction of a power house. It will be four stories high, 55x170 ft., of brick. J. T. Windrim, Commonwealth Building, is the architect.

The Street & Forkran Co., Baltimore, Md., has leased a building at Howard and Dover Sts., and will remodel and equip it as a pork-packing and refrigerator plant.

SOUTHERN STATES

The derrick, electric motor house and belt house of the Virginia Oil & Gas Co., Warwood, W. Va., were burned, May 12. Loss, $2500.

The Alamance Power Co., Burlington, N. C., has incorporated with $300,000 capital, and will erect a hydro-electric power plant, at Rine Falls. F. L. Williamson is the president.

A cotton mill is proposed by R. J. Stough, to be located at Cornelius, N. C.

The New London Development Co., Arcade Building, Greensboro, N. C., will erect a brick and tile plant, at an estimated cost of about $10,000.

The Ledbetter Mfg. Co., Rockingham, N. C., has let the contract for a spinning mill, at Ledbetter.

F. G. Staudt will erect a one-story brick bakery, to cost $3000, at Raleigh, N. C.

The plant of the American Tobacco Co., Winston-Salem, N. C., was damaged by fire at a loss of about $400,000.

The Southern Cotton Oil Co., New York, will erect a cotton gin at Easley, S. C.

The Fairmont Mfg. Co., Fairmont, S. C., is making improvements that include installing dobby heads to change its plain looms to fancy goods.

The flour mill of the J. M. Veach Co., at Adairsville, Ga., was burned, May 7. Loss, $20,000, covered by insurance.

The Milstead Mfg. Co., Conyers, Ga., will enlarge its cotton mill.

Cartersville, Ga., contemplates the expenditure of $50,000 for improvements to its gas plant. G. W. Young is the mayor.

The Savannah Brick Works, Eden, Ga., was damaged by fire, at a loss of $50,000. H. B. Skeele is the president.

The G. S. Baxter & Co.'s sawmill, Fargo, Ga., was damaged by fire.

The E. A. Smith Mfg. Co., Granite Falls, Ga., has let the contract for a 15,000-spindle cotton mill to cost about $500,000.

John W. Wolcott, W. A. Jester, J. P. Nichols and B. R. Blakely will erect a cannery at Griffin, Ga.

The Chamber of Commerce will erect a brick laundry building, at Lagrange, Ga.

The Savannah Brick Works, Savannah, Ga., were destroyed by fire, May 9. Loss, $50,000, partly covered by insurance.

The Edison Illuminating Co., Savannah, Ga., is to erect a group of buildings.

The North Birmingham Packing Co. will erect additions on Twenty-fourth Ave., Birmingham, Ala.

The Cureton Sash & Door Co., Dothan, Ala., will rebuild its factory, recently destroyed by fire, at a loss of $20,000.

The English Carriage Co., Mobile, Ala., has started work on the erection of a harness and saddle factory. W. T. McGowin is the president.

The Madrid Cotton Oil Co., Madrid, Ala., will erect and equip an oil mill.

Fire in the basements of the buildings at 18, 20 and 22 North Second St., Memphis, Tenn., occupied by S. C. Toof Printing Co., Galloway Coal Co. and Patterson Transfer Co., caused $25,000 damage, May 8.

The American Gyanimid Co., Nashville, Tenn., will erect a $1,000,000 plant, at Florence, Ala.

The A. & T. Power Co., Sparta, Tenn., will construct a power plant, at an estimated cost of $100,000.

R. P. Earls, Campbellsville, Ky., has plans for the erection of a large sawmill.

Phelps & Son, Cloverport, Ky., will erect a button factory at once.

J. L. Faulkner contemplates erecting a steam plant for redrying leaf tobacco, at Danville, Ky.

The Kentucky Traction & Terminal Co. will build a substation at Nicholasville, Ky. I. L. Oppenheimer is the general manager.

The plow-handle plant of the McMillan Mfg. Co., Louisville, Ky., was damaged by fire, at a loss of $20,000.

The McMillan Mfg. Co., 1236 Beech St., Louisville, Ky., was damaged by fire at a loss of $20,000. It will probably be rebuilt. Thomas McMillan is the president.

The Louisville & Interurban Ry Co., 20th and High Sts., Louisville, Ky., is erecting a power plant to cost $500,000. The contract for the excavation, foundations, water intakes and discharges has been awarded to the Henry Bickel Co.

The Board of Education, Louisville, Ky., is considering the installation of manual training equipment in three schools. Samuel D. Jones is the business director.

The Louisville Soap Co., 1304 Shelby St., Louisville, Ky., will install machinery for the manufacture of glycerin.

MIDDLE WEST

The Ohio Limestone Co., Bellevue, Ohio, will buy some new power-plant equipment.

The Kurtner Refrigerator Co., 320 Clinton Ave., Cleveland, Ohio, is contemplating the erection of a factory of brick and steel. The estimated cost is $10,000.

Theodore Kundtz, cabinet maker, Cleveland, Ohio, will build an addition to his plant.

The Cleveland Tanning Co., manufacturer of hides, Cleveland, Ohio, is erecting a new factory.

The National Box Co., Cleveland, Ohio, was destroyed by fire, at a loss of $25,000.

The Cleveland Electric Illuminating Co., Cleveland, Ohio, will need new electrical equipment for a large new substation to be built.

The Acme Box & Lumber Co., Cleveland, Ohio, will make additions to its factory.

The Peerless Paint Mfg. Co., Cleveland, Ohio, will build an addition to its plant.

The Standard Sausage Mfg. Co., Cleveland, Ohio, will buy new power-plant equipment for its new factory. J. Steiner is the manager.

The J. H. & L. Stadler Co., Cleveland, Ohio, fertilizer maker, will build an addition to its factory.

The Noel Candy Co., Canton, Ohio, will buy candy-making machinery.

The Dayton Cone & Ice Cream Mfg. Co., Dayton, Ohio, will buy a gas engine.

The National Clay Co., Hatton, Ohio, is in the market for new power-plant equipment.

The Ohio High Grade Oil Refining Co., Junction City, Ohio, will erect an oil refinery.

The Index Piano Bench & Cabinet Co., Kingsville, Ohio, maker of piano benches, music cabinets, etc., will buy some new wood-working machinery. B. F. Mooney is the manager.

The McConnell Overalls Co., Mt. Vernon, Ohio, will erect an addition to its plant.

The Union County Telephone Co., Marysville, Ohio, will buy equipment for a new telephone exchange.

The Licking Light and Power Co. will construct a new power plant, at Newark, Ohio. H. L. Montgomery is the manager.

The East Palestine Pottery Co.'s plant, East Palestine, Ohio, was damaged by fire, May 5.

Bids for the $16,000 plant of the Pure Milk Co., on Gallia St., Portsmouth, Ohio, were opened by architects Devoss and Patterson and contracts have been awarded.

The Rockford Electric Lighting Co., Rockford, Ohio, will buy electric equipment for its enlarged plant.

The Toledo Sugar Co., Toledo, Ohio, has let contracts for its new plant at Rossford.

The Owens Bottle Machine Co., manufacturer of machines for bottling liquids and labeling bottles, Toledo, Ohio, is erecting a new factory on Libby St. Noted Mar. 4.

The Mellink Mfg. Co., manufacturer of furniture, Toledo, Ohio, is erecting a new factory on Oakwood Ave.

The Ladoga Veneering Mill, Crawfordsville, Ind., was destroyed by fire at a loss of $40,000.

Two new canning factories are being erected at Petersburg, Ind., one by W. H. Hufford, of Dalesville, and the other by the Campbellsburg Canning Co., composed of local capitalists.

The Wayne Shoe Co., Detroit, Mich., manufacturer of shoes, was partly destroyed by fire.

The American Hide & Leather Co., manufacturer of leather goods, Detroit, Mich., will erect an addition to its tannery.

Plans have been prepared for improving the municipal electric-light plant of Holland, Mich., at an estimated cost of $26,000.

The sawmill of Nadeau Bros., Nadeau, Mich., was destroyed by fire, May 10. Loss, $35,000.

Cooney & Smith will erect new additions to their furniture factory on South Washington Ave., Saginaw, Mich.

The plant of the Standard Varnish Co., 2620 Armour Ave., Chicago, Ill., was damaged by fire, May 7. Loss, $4000.

The Commercial Furniture Co., 2718 West Superior St., Chicago, Ill., will erect a three-story factory building, to cost $20,000.

Supple & Foseman, Danville, Ill., propose to build a factory, at Evansville, Ind., and will manufacture cement posts.

The Litchfield Mill & Elevator Co., Litchfield, Ill., owned by C. B. Munday & Co., is letting contracts for the building of a corn-products mill to be located on its property adjacent to the O. K. Mill, which is owned by the same company.

The Spring Valley Mfg. Co., manufacturer of overalls, will erect a plant at Waterloo, Ill.

Harry D. Baker, St. Croix Falls, Wis., will construct and operate an electric-light plant, at Balsam Lake.

The Federal Rubber Mfg. Co., Milwaukee, Wis., is having plans prepared for a six-story building, 100x400 ft.

Bids are being received by the Peoples' Brewing Co., Oshkosh, Wis., for the construction of a new brewery at 15th and South Main Sts. The estimated cost is $100,000. William C. Kargus is the secretary.

The broom factory of Jacob Stein, Sheboygan, Wis., was burned, May 10. Loss, about $1000.

WEST OF THE MISSISSIPPI

The power house of the Waterloo, Cedar Falls & Northern Ry. Co., at Waterloo, Iowa, was destroyed by fire, May 7. Loss, $125,000.

The contract for the construction of a four-story and basement plant for the Albert Lea Packing Co., Albert Lea, Minn., has been awarded.

The glaze mill of the E. I. du Pont de Nemours Powder Plant, Wilpen, Minn., was burned, May 11. Loss, $6000.

Bids will be received by Maj. G. G. Bailey, Constructor Q. M., U. S. A., Fort Leavenworth, Kan., until 11 a.m., May 27, for constructing a garbage crematory, at Fort Leavenworth.

The citizens of DeWitt, Neb., will vote bonds for $21,000 for the erection of a water-works plant.

The Norfolk Electric Light & Power Co., Norfolk, Neb., will build a power house, 60x100 ft. J. C. Stitt is the architect.

The citizens of Verdigris, Neb., will vote on June 3 on the proposition of issuing bonds for $4000 for the construction of a water-works system.

The city of Northwood, N. D., will soon vote for installing a modern lighting system.

The Big Horn Canyon Irrigation & Power Co., Billings, Mont., is contemplating the erection of an 800,000 hp. hydro-electric power plant.

The Hofman Box Co., Kansas City, Mo., will establish a crate and box factory, at Dallas, Tex.

The Weil packing Co., Evansville, Ind., has had plans prepared for the construction of a four-story packing plant, to be built in Little Rock, Ark. The estimated cost is $100,000.

The city of Wynne, Ark., will install a water-works system and rebuild its electric-light plant. Richard C. Huston, Exchange Building, Memphis, Tenn., is consulting engineer.

Fire damaged the Conkling Mill and the plants of the J. L. Markham Lumber Co. and the Dallas Box & Crate Co., Dallas, Tex., on May 6. Loss, $35,000, partly covered by insurance.

The Lindale Farmers' Canning Co., recently incorporated, with a capital of $4000, will install a canning plant, at Lindale, Tex. T. L. Arthur and J. W. Dismukes are interested.

The citizens of Palacios, Tex., have voted bonds of $25,000 for the improvement and construction of extensions to the water-works system.

The contract has been awarded for the construction of a water-works system and a 250,000-gal. concrete reservoir, at Avard, Okla.

E. E. Holcomb, of Stigler, Okla., will establish a cotton-seed oil mill, at Nacoma, Tex.

The city council has granted a 20-year franchise to R. O. Langworthy, San Antonio, Tex., and associates for the installation of a gas manufacturing plant and the construction of a distributing system, at San Marcos, Tex. The improvement will cost about $40,000.

The Thrall Gin Co. will install a new cotton gin, at Thrall, Tex., at a cost of about $10,000.

The E. I. du Pont de Nemours Powder Co., Bartelsville, Okla., will erect a factory to replace the one recently destroyed by the overflow from Sand Creek.

George H. Walker, Muskogee, Okla., will erect a cotton-seed oil mill, at McAlester, Okla., to cost about $100,000.

WESTERN STATES

The Kittitas Brick & Pottery Co., Ellensburg, Wash., recently incorporated by Fred Gilmore, O. O. Falkner, and V. C. Denny, will soon erect a plant at Ellensburg for the manufacture of clay brick and clay pottery.

The plant of the Pioneer Paint & Wall Paper Co., Hoquiam, Wash., was damaged by fire, May 8.

The citizens of Index, Wash., have voted to issue $9000 bonds for constructing water-works. Noted May 9.

The Olympia Cedar Mill Co., Olympia, Wash., is having plans prepared for rebuilding its plant which was recently damaged by fire. The estimated cost of the new building is $10,000.

The Pacific Fruit Package Co., Raymond, Wash., is constructing an addition to its factory. New machinery will be installed.

Work has been started on the new plant of the Seattle Cracker & Candy Co., Seattle, Wash. Noted Feb. 22.

Sehr & Bohland, Portland, Ore., have secured a site at Sedro Woolley, Wash., and will erect a starch factory.

The city of Grants Pass, Ore., will soon hold a special election to vote on issuing bonds for $4000 for the erection of a light and water-works plant.

The shingle-mill plant of the Butterfield Shingle Co., Shanghi, near Kelso, Wash., was destroyed by fire, caused by a boiler explosion.

H. A. Jansen, Chicago, Ill., has started the erection of a plant, at Medford, Ore., for the manufacture of hydraulic brick, building blocks, caps, arches, chimneys and fancy designs of all kinds.

The Washington Rendering & Fertilizing Co., Seattle, Wash., has started the erection of a large plant, at Appletree Point, near Kingston, Wash. The plant will manufacture fertilizer, tallow and chicken food.

The Mansfield Elevator & Warehouse Co., Mansfield, Wash., is having plans prepared for the construction of a flour mill in connection with its elevator.

The Pomeroy Livestock Meat Association, Pomeroy, Wash., will soon install a five-ton ice-making and refrigerating plant.

The Hague Box & Lumber Co., Tacoma, Wash., will add a sash and door factory to its plant. It will have a daily capacity of about 350 doors.

The city of Clatskanie, Ore., will soon hold a special election for the purpose of voting on issuing bonds for $30,000 for the construction of a new water-works system.

Work has been started on the plant of the Imperial Cannery Co., Imperial, Calif. Noted May 16.

The city of Los Angeles, Calif., is contemplating the installation of a garbage reduction plant. W. M. Humphreys is commissioner of public works.

W. D. Klausman, Merced, Calif., will soon erect a large fruit-canning plant, at Merced.

M. G. Russell, Eau Claire, Wis., is contemplating the erection of a flour mill, at Modesto, Calif.

The laundry at 2928 Twenty-fifth St., Oak Park, Calif., owned by P. T. Wakimtoto, was burned, May 7. Loss, $3500.

The city of San Bernardino, Calif., will soon begin the erection of a new oil-heating plant.

The city of San Diego, Calif., will soon hold a bond election to vote on issuing bonds for $340,000 for improvements and extensions to its water system.

The La Grande Laundry Co., San Francisco, Calif., has taken out a permit to build a large addition to its steam laundry plant. The estimated cost is $30,000. J. E. Krafft & Sons, Phelan Building, San Francisco, are the architects.

The City Supervisors, San Francisco, Calif., will construct another building, at the Islais Creek incinerating plant, on Army St., between Kansas and Rhode Island Sts. Cost, not to exceed $90,000. Marsden Manson is the city engineer.

The City Council of Stockton, Calif., has authorized the mayor to purchase land upon which to build a city incinerator, pumping plant, and septic tanks.

The city of Vallejo, Calif., will soon hold a bond election to vote on issuing bonds for $175,000 for the establishment of a municipal light and power plant.

CANADA

Bids were received, May 14, by Neil F. Macnachtan, county clerk, Cobourg, Ont., for sewage disposal works for the House of Refuge, Cobourg. T. Aird Murray, 303 Lumsden Building, Toronto, Ont., is engineer.

The Davis Leather Mfg. Co., Newmarket, Ont., will double the capacity of its plant.

The city of Toronto, Ont., is considering the construction of a water-works pumping plant, at North Toronto. The estimated cost is $60,00.

The Copp Clark Stationary Mfg. Co., Toronto, Ont., will construct a large addition to its plant.

The Toronto Carpet Co., Toronto, Ont., has acquired a site adjoining its present factory and will erect an additional factory. The estimated cost is $100,000.

Bids will be received until noon, June 25, by the City Commissioners, Saskatoon, Sask., for the complete installation of a 70-ton per 24 hours incinerator plant, and the operation of same for a period of three months after completion. Contractors are to bid on their own plans and specifications.

The Blairmore Brick Co., Blairmore, Alta., will double the capacity of its plant and install new machinery.

The main factory of the Royal City Mill, New Westminster, B. C., was destroyed by fire, May 14. Loss, $100,000, covered by insurance.

The City of Oak Bay, B. C., is contemplating the installation of a new water-works system.

The Powell River Pulp & Paper Co., Ltd., Powell River, B. C., is planning to double the capacity of its plant.

The contract for the construction of a four-story factory, 50x400 ft., at Lancaster, N. B., for the T. S. Simms Co., Ltd., St. John, N. B., manufacturer of brushes and brooms, has been awarded. Lockwood, Greene & Co., Boston, are the architects. Noted Apr. 11.

The grain elevators of the Maple Leaf Milling Co., Brandon, Man., were burned, May 11. Loss, $100,000.

New Incorporations

GENERAL MANUFACTURING

The following companies have been incorporated to manufacture:

The Corinna Mfg. Co., Corinna, Maine; woolen and other textile fabrics. Capital, $50,000. J. H. Winchester is president, and J. E. Grey is treasurer.

The Atlantic Handle Co., Malden, Mass.; handles. Capital, $10,000. Incorporators, Francis Hastings and George B. Hastings, Brookline, Mass.

The Stansfield Felting Mills, Oxford, Mass.; felt. Capital, $300,000. Incorporators, Robert G. Dodge, Newburyport; F. Walker Johnson, Lynn, and R. H. Johnson, Cambridge, Mass.

The Frisole Co., Beacan Falls, Conn.; footwear. Capital, $5000. Incorporators: Tracy S. Lewis, Beacon Falls; Richard L. Fisher, Waterbury, and John U. Ferris, Naugatuck.

The Hall Organ Co., Orange, Conn.; organs. Capital, $65,000. Incorporators: Harry Hall, Frederick Campkin and George A. North, all of New Haven, Conn.

John S. Martin & Co., Inc., Boonville, N. Y.; dairy products. Capital, $50,000. Incorporators: Clinton S. Martin, James W. Vail, 100 Hudson St., and John E. Ormsbee, 9 Liberty St., New York, N. Y.

The F. W. Kraft & Sons Co., Bronxville, N. Y.; leather goods. Capital, $30,000. Incorporators: F. W. Kraft, W. F. Kraft and and J. Kraft.

The C. W. Herrick Mfg. Co., Jamestown, N. Y.; piano cases and furniture. Capital, $100,000. Incorporators: C. M. Herrick, Milton Bailey and C. L. Liedblad, Jamestown, N. Y.

The Kingston Rubber Brush Co., Kingston, N. Y.; brooms, brushes and dusters. Capital, $150,000. Incorporators: W. H. Clark, J. M. Lester and S. Bernstein.

The Dougherty-Wilkinson Co., Inc., Boro. Manhattan, N. Y.; life-saving device. Incorporators: C. Dougherty, H. F. Wilkinson and F. P. Lewis, Brooklyn, N. Y.

The Irving Mills, Boro. Manhattan, N. Y.; cotton goods. Capital, $25,000. Incorporators: J. J. Schwebel, I. Weiser and M. Winder, New York, N. Y.

William E. Notman, Inc., Mt. Vernon, N. Y.; novelties. Capital, $10,000. Incorporators, William E. Notman, Nellie Notman and Gustav R. Hamburger.

The Standard Flouncing Co., New York, N. Y.; laces and embroideries. Capital, $150,000. Incorporators: H. B. Davis, M. M. Edelman and J. Santzer, New York, N. Y.

The Dutchess Brick Machine Kiln Co., Newburgh, N. Y.; brick. Capital, $500,000. Incorporators: Henry H. Chapman, Glenridge, N. J.; William H. Bartlett, Amenia, N. Y., and George H. Boutecon, Newburgh, N. Y.

The American Mineral Wood Mfg. Co., Poughkeepsie, N. Y.; artificial wood and building materials. Capital, $200,000. Incorporators: A. C. Coursen, J. Ferla and W. Knauss.

The Galloway & Desbrow Shoe Co., Rochester, N. Y.; shoes and boots. Capital, $10,000. Incorporators: Sumner M. Galloway, Clarence T. Galloway and Fred Desbrow, all of Rochester.

The Interstate Films Co., 419 Market St., Camden, N. J.; films, lenses and cameras. Capital, $14,000. Incorporators: C. U. Martin, E. T. Vennel and I. C. Clew, all of 419 Market St., Camden.

The England Leather Co., Camden, N. J.; leather goods and novelties. Capital, $125,000. Incorporators: P. England, R. England, Camden, and A. H. Hefner, Philadelphia, Penn.

The Fort Plain Electric Piano Co., Ft. Plain, N. J.; pianos, organs and other musicial instruments. Capital, $11,000. Incorporators, John M. Yordon, Alton A. Walrath and John C. Jackson.

The New Jersey Parquet Floor Co., Jersey City, N. J.; parquet and other floorings. Capital, $25,000. Incorporators: R. B. Daggett, New York, N. Y.; E. J. Kane and S. J. Fitzgerald, Jersey City.

The Yonkers Paper Co., Yonkers, N. Y.; paper. Capital, $3000. Incorporators, Samuel Botkin, 100 Woodworth Ave.; David Gorfinkel, 45 Warburton Ave., and Jacob Fischman, Warburtin Ave., Yonkers.

The Muller Paper Goods Co., Ridgewood, N. J.; paper goods. Capital, $10,000. Incorporators, Henry Muller, Valentine Muller, 703 Linden St., Ridgewood, and Edward Schuster, 393 Stanhope St., Brooklyn, N. Y.

The Greif Bros. Cooperage Co., Cleveland, Ohio; barrels, kegs and other receptacles. Capital, $300,000. Incorporators, John M. Garfiels, W. L. David and G. M. Cummings.

The Index Piano Bench & Cabinet Co., Kingsville, Ohio; piano benches and music cabinets. Capital, $10,000. Incorporators, B. F. Mooney, F. L. Leffingwell and Henry C. Hardy.

The Sanitary Flooring, Marble & Tile Co., Gary, Ind. Capital, $10,000. Incorporators: A. T. Hess, Dan Malloy and W. S. Feuer.

The Kankakee Valley Pearl Co., Kankakee, Ill.; pearl buttons and other commodities. Capital, $100,000. Incorporators: E. H. Ehrhorn, W. B. Johnson and C. G. Traver.

The Tulsa Cabinet Mfg. Co., Tulsa, Okla. Capital, $10,000. Incorporators, A. J. Helvern, Charles H. Mitchell and Ora W. Helvern.

TRADE CATALOGS

The Taft-Peirce Manufacturing Co., Woonsocket, R. I. Booklet illustrating the plant.

Rectigraph Co., Rochester, N. Y. Catalog. Photographic copying machines. Illustrated, 38 pages, 6x9 in.

Wallace Supply Co., Chicago, Ill. Catalog. Hand power bending tools. Illustrated, 16 pages, 6x9 in.

The Hinckley Machine Works, Hinckley, Ill. Folder. Milling attachment and compound table. Illustrated.

The Allen Manufacturing Co., Hartford, Conn. Catalog and price list No. 11. Safety set screw. Illustrated.

J. H. Williams & Co., Brooklyn, N. Y. Catalog 1912. Wrenches, Drop Forgings. Illustrated, 134 pages, 6x9 in.

Langelier Manufacturing Co., Providence, R. I. Bulletin 28-32, multiple drilling machines. Illustrated.

Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog. Pillar and jib cranes. Ilustrated, 40 pages, 6x9¼ in.

Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass. Pamphlet, hand and power shears and bending rolls. Illustrated.

Business Item

The Eck Dynamo & Motor Co., Belleville, N. J., announces the removal of their New York office to 31 Warren St. from 19 Murray St. The new office will be under the management of W. L. Fort, for many years connected with the Western Electric Co.

Forthcoming Meetings

American Society of Mechanical Engineers. Spring meeting, May 28-June 1, Hotel Hollenden, Cleveland, Ohio. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June 12-14. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June 17-19. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

Society for the Promotion of Engineering Education. Annual meeting, June 26-28, Boston, Mass. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

Society of Automobile Engineers, summer meeting, June 27-29, Hotel Ponchartrain, Detroit, Mich. C. F. Clarkson, secretary, 1451 Broadway, New York City.

American Railway Tool Foreman's Association. Annual convention, July 9, 1912, Chicago, Ill. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Foundrymen's Association. Annual convention, Buffalo, N. Y., Hotel Statler, Sept. 24, 25, 26. Richard Moldenke, secretary, Watchung, N. J.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. Walter M. Smyth, secretary, 116 Nassau St., New York City.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

SUPERINTENDENT wanted for factory employing about two hundred and fifty men in the manufacture of steel stampings; technical education desirable, but not essential, but must be able to obtain maximum production at a minimum cost. Address, stating education, experience and salary desired, "Connecticut," care Am. Machinist.

SALESMAN to sell well known good high speed steel in Connecticut; able, energetic man with good standing and Connecticut acquaintance only need reply; correspondence confidential. Box 330, Am. Machinist.

ENGINEER-SALESMEN—Manufacturer of well known high-grade automobile, about to place motor trucks on market, has opening for several engineer-salesmen competent to take charge of truck departments at its branches as business develops; experience in motor trucks not required, but selling ability and mechanical knowledge essential; exceptional opportunity for men of proper caliber; state experience, references, salary desired, age, married or single. Address "R. S.," Am. Machinist.

Illinois

DRAFTSMEN AND TRACERS — We are constantly in need of the services of first-class draftsmen and tracers; some men are required on tool work and it is possible to place some on detailed and assembled drawings of agricultural implements. Applications requested addressed David Bradley Manufacturing Works, Bradley, Ill.

Indiana

FOREMEN — A growing automobile factory is in need of foremen; state fully your experience, give age and salary expected. Box 293, Am. Machinist.

SUPERINTENDENT, a high grade, or foreman for tool room in modern factory; must be competent teacher of men and thoroughly conversant with improved shop methods; give experience and references. Box 337, Am. Machinist.

SUPERINTENDENT for a department of our works devoted to the manufacture of very accurate small cast iron and steel gears; must be a high grade, high minded mechanic who is naturally qualified to train and hold his workmen and who is well informed on modern tools and shop practices; information as to experience, references and qualifications for such position will be treated confidentially; a good opportunity for the right man. Box 336, Am. Machinist.

Iowa

MECHANIC, first class, capable of handling gear cutting in a large factory in Iowa; must be familiar with all kinds of gears, bevel, spiral and spur. Box 253, Am. Machinist.

FOREMAN — Experienced automatic machine foreman, capable of tooling Brown & Sharpe, National Acme, Cleveland and Potter & Johnston machines and producing accurate work at the least cost; permanent position; state experience and wages expected. Address "Automatic," Am. Machinist.

Kansas

MACHINIST, expert; give references and experience upon different machines and with gasoline engines. Box 329, Am. Machinist.

Maryland

DRAFTSMAN, experienced in high-speed stationary engines. Box 227, Am. Machinist.

Massachusetts

LIVE MEN in each state to handle a line of high-speed tools on commission; state whether entire time could be devoted or whether it would be taken as a side line; references required as to ability and character. Address P. O. Box 3234, Boston, Mass.

New Jersey

MECHANICAL DRAFTSMEN, three experienced, and designers, for permanent positions with large manufacturing concern in New Jersey; state age, education, experience and salary expected. Box 333, Am. Machinist.

New York

DESIGNER on bakers' machinery; to a man with inventive ability, a good salary will be paid. Address "Bakers' Machinery," Am. Machinist.

DRAFTSMEN for small machine tools; those with experience in designing electrical devices preferred. Reply to "C. S.," care Doremus & Co., 44 Broad St., N. Y.

DESIGNER—Man with experience in tool designing for small electrical apparatus; state experience, age and wages expected. Address P. O. Box 794, Rochester, N. Y.

YOUNG MAN with experience in small instrument and model making; permanent position to the right man; state experience and salary expected. Edwards & Co., 140th and Exterior Sts., New York.

OPERATORS—Automatic screw machine, on Brown & Sharpe and Acme machines; state experience and wages expected; references required. Address Camera Works, Eastman Kodak Co., Rochester, N. Y.

OPERATORS—Automatic screw machine operators on Brown & Sharpe and Acme machines; state experience and wages expected; references required. Address Camera Works, Eastman Kodak Co., Rochester, N. Y.

DESIGNER, experienced on woodworking machinery for a large shop in New York state; must be familiar with shop practice and operation of machines; give references and salary expected. Box 331, Am. Machinist.

TOOL MAKERS, few first class, on small accurate work; good wages and steady employment; also two screw machine hands; only competent men need apply. Bundy Mfg. Co., Endicott, N. Y.

ASSOCIATE EDITOR for a technical journal in the machine-building field; a technical education or its equivalent; thorough experience in machine design and machine shop practice, and demonstrated ability to write are essentials. Box 300, Am. Machinist.

MECHANICAL DRAFTSMAN competent to take responsible charge of design of boiler, tank and other riveted work, general machinery, condensers and steam specialties; will consider only men with experience, including preferably marine steam plant practice; applicants should give age and full details of previous work, with dates and places of employment, and salary expected. Box 325, Am. Machinist.

Ohio

MACHINE TOOL SALESMAN, first class, to represent a large manufacturer; a good position for the right party. Box 327, Am. Machinist.

SALESMAN in the New England territory for a special line of machine tools; young man with thorough shop training required. Address, stating age, experience, etc. Box 328, Am. Machinist.

EFFICIENT EXECUTIVE in drafting room, with experience in machine tool design, preferably lathes and their attachments; applicant must be capable of handling men, and get the work through accurately and without delay; do not apply unless you have had several years' experience in work of this character; please give complete references and salary expected. Box 305, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

A SUCCESSFUL COMPANY, having one of the most modern plants in the country, employing over 500 men on high grade machinery, wishes to engage a man about 35 years of age to become associated with it as assistant superintendent to start with, and if satisfactory results are shown to later become superintendent or works manager; applicant must be a high grade man, both as to character and ability, of good presence and with both technical and shop training; company has designing engineers, but applicant must have good judgment as to mechanical design; in plain words, a man is wanted who can in time take the responsibility of shop production of the company, and if desired, an opportunity will be given, in due course, to become financially interested in it; preference will be given a man who has had some experience in the manufacture of machine tools; in making application give full information as to experience, etc.; application will be treated as strictly confidential. Box 334, Am. Machinist.

Pennsylvania

DRAFTSMEN, several; applications solicited from men with either ordnance, mechanical-electrical, or mechanical-structural experience; state fully age, experience, education and salary expected. Box 319, Am. Machinist.

ESTIMATOR, capable of estimating the time required to finish castings or forgings in a shop equipped with large and heavy tools; preference will be given to applicants with correspondence or technical school training in addition to machine shop experience; applicants for the position will state in full experience, training, education, salary expected, etc. Treadwell Engineering Co., Easton, Penn.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wisconsin

FOREMAN to take charge of machine floor by a firm manufacturing paper mill machinery; in reply please state age, experience and salary expected, also give references. Box 332, Am. Machinist.

MANUFACTURING concern desires a man with some experience to take charge of chemical and physical laboratory, steel work chiefly, including analysis and heat treatments. Address, stating experience and salary, Box M. L., Am. Mach.

FOREMAN required for transmission and axle assembly departments in automobile part manufacture; applicant must have successfully handled such departments on progressive methods; state full particulars and salary expected. Box 314, Am. Machinist.

SUPERINTENDENT at once, to take charge of the manufacture of a high grade air rifle; must understand thoroughly the designing of special tools, jigs and dies for rapid production; must be able to take full charge of the manufacturing end of this business, and be able to produce this article in large quantities with interchangeable parts and at the minimum of cost; must also understand thoroughly the handling of men; a large salary will be paid to the right man; give your experience fully and in detail in first letter. Shue High Pressure Air Rifle Co., Milwaukee, Wis.

BECAUSE of the rapid growth in our business we are constantly on the lookout for keen, able and practical men in the various departments of our works; for men above the average such positions offer splendid opportunities; in addition to our assembling rooms, we operate our own machine shops, drop forge plant, foundries and body works and invite correspondence from men whose experience convinces them that their ability is above the ordinary; one-third of our present employees have been with the management of this company from eight to twenty-six years. Address Factory Manager, The Thomas B. Jeffery Co., Kenosha, Wisconsin.

Positions Wanted

Connecticut

DRAFTSMAN with various experience, some experience as detailer on machine tools, wishes change. Box 317, Am. Mach.

ASSISTANT SUPERINTENDENT or foreman, technical education, married, age 40, desires responsible position. Box 320, Am. Machinist.

Illinois

DESIGNER, experienced, with thorough shop experience in motor trucks, auto fire engines, rotary and piston type, desires position with live concern. Address Box 312, Am. Machinist.

Indiana

BY YOUNG married man; best of refrences; 12 years' experience in the treatment of steel and would like to obtain position with a steel corporation in the demonstration and selling of steel, both tool and machinery. Box 326, Am. Mach.

Massachusetts

DESIGNER—Practical mechanic, with broad experience, designer of automatic machinery and modern tools, desires responsible position. Box 342, Am. Mach.

SUPERINTENDENT — Assistant or general foreman; technical graduate, 17 years' practical experience, 13 years as foreman. Box 341, Am. Machinist.

New Jersey

FOREMAN—Practical mechanic and executive, general shop experience, desires a position as foreman or production manager; references. Box 345, Am. Mach.

MECHANICAL DRAFTSMAN, having eight years' experience as machinist and toolmaker, also two years of designing machinery, desires position; technical education. Box 344, Am. Machinist.

SUPERINTENDENT — Fully experienced throughout the shop and foundry; unexcelled as tool and machine designer; long and broad experience on economical design of either simple or intricate medium weight machinery; positive reduction in manufacturing costs and improved quality of product; large capacity for work; resourceful, responsible. Box 348, Am. Machinist.

New York

MECHANICAL DRAFTSMAN, various experience, wishes position. Box 323, Am. Machinist.

DRAFTSMAN wishes position; technically educated; 3½ years' combined shop and office experience. Box 343, Am. Mach.

DRAFTSMAN—Five years' successful designing experience, four years' shop experience; can make good with reliable concern. Box 311, Am. Machinist.

MECHANICAL ENGINEER, graduate, German, 26, seven years' practical experience, four years in United States, wishes position. Box 350, Am. Machinist.

SUPERINTENDENT or general foreman of small or medium manufacturing, at present employed at good salary, wishes to change. Box 340, Am. Mach.

TOOL DESIGNER, young man, seeks responsible position; 10 years' experience on high-class instrument work; first-class technical education. Box 347, Am. Machinist.

SALESMAN, 32, with five years' shop practice and thorough knowledge of the trade, open for engagement; best references; hustler and producer of results. Box 351, Am. Machinist.

FOREMAN of sheet metal tool and die room, drawing dies a specialty; several years' experience in die designing; wishes a change of location; can furnish A1 references. Box 321, Am. Machinist.

MECHANICAL ENGINEER, age 29, married; high-class executive; seven seven years with present employers; now and for past four years head of mechanical department of large heavy metal products plant; will make change for prospects of bigger future. Box 349, Am. Machinist.

MECHANICAL ENGINEER, 34, technical education, with broad practical experience in shop, office and field, power-plant apparatus and general machinery; competent to develop and superintend output of mechanical or electrical product; can produce results; open for immediate engagement. Box 352, Am. Mach.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

Pennsylvania

SUPERINTENDENT, now holding this position in a large plant, high-grade work, wants a change; thorough mechanic; good executive ability. Box 346, Am. Machinist.

Rhode Island

DRAFTSMAN and designer, thoroughly familiar with designing motor cars and trucks, desires to change position. Box 339, Am. Machinist.

Miscellaneous

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Work for 2x24 Jones & Lamson lathes and work for automatic gear cutters wanted. Box 267, Am. Machinist.

For Sale—Complete and only machine shop in best and fastest growing city in southeast Missouri. Box 338, Am. Mach.

We manufacture machinery, but want to take on something in addition to increase our yearly business. What have you to offer? Box "A. X.," Am. Mach.

For Sale—One 8"x24" Allis-Chalmers Corliss engine; one four-spindle Turner cock grinder; first-class condition. For prices apply to J. E. Lonergan Co., 211 Race St., Philadelphia, Penn.

American patent rights(1911) for sale of a stump extractor invented in Sweden and used throughout that country most successfully. Apply for details to Canadian Boving Co., Ltd., 164 Bay St., Toronto.

Machine shop wanted in the vicinity of New York City, with equipment adapted for the manufacture of small and medium size electric machines and devices; in replying, give full particulars, location, rent, price, etc. Address Box 3-E, care Doremus & Co., 44 Broad St., New York.

Two electric traveling cranes, direct-current, 220 volts preferred, wanted; first-class second-hand condition and quick delivery; one to be from 5- to 20-ton capacity, 60-ft. span or more, the other 40- to 60-ton and 50-ft. span or more. Address Woodbury Granite Co., Bethel, Vermont.

Open-end planer, 6 ft. wide, 12-ft. stroke, also good milling machine with gear-cutting attachments wanted; must be modern, in good condition, capable of doing accurate work and offered at real bargain; give detailed and illustrated description and state lowest price in first letter. Wm. L. Packard, Geneva, N. Y.

For Sale—All or considerable part of a $200,000 manufacturing business, largely in the metal line; location the best; good buildings, well equipped with uptodate machinery; excellent staff of skilled workmen; unusually good relations with employees; never an hour of labor troubles; business on a prosperous, money-making basis, built up in a few years from a very small beginning from its own profits, and capable of rapid increase in capacity and value; reason for selling, old age of principal owner; on certain conditions would retain large or small part of ownership, in which case it would be deemed an advantage to have the purchase divided among a number, especially if all or part of the investors were qualified to take an active part in the work or management. "Y. B.," Am. Machinist.

Estimates wanted from responsible machine shop in Greater New York or within easy reach for machine work which requires uptodate equipment for both heavy and light work; drawings open for inspection at our office. Hanau Engineering Co., 74 Lafayette St., New York City.

Talks With Our Readers

By The Sales Manager

Here's another letter in regard to the classified columns—a vital part of any live publication.

* * *

"American Machinist":

I have always been a close reader of the "Talks with Our Readers" page, ever since it was started, and so I thought I would write a letter for it on the subject that in my estimation has not received the attention it deserves. That is the want ad. column. So I will relate a personal experience in getting a job through the "American Machinist."

It was about five years ago that I first started to read the "American Machinist." I was not then a regular subscriber, but was in the habit of buying one now and then at a news stand.

I found that many or in fact most of the others in the shop where I was employed had secured their positions through the help wanted or situations wanted columns, so I started to keep a close watch and answer all the ads. in my line, and it was not long until I secured a desirable position, at a total cost of probably a dollar, counting the cost of the "American Machinists" I had bought and stationery and postage, which compared very favorably with the sixty or seventy dollars it would have cost through an employment agency.

For four dollars a year, besides the general reading matter, I secure a weekly list of positions open which are exactly in my line, every one bona fide, which is far better than paying three dollars quarterly for the employment agency list alone.

So since that time I have been reading the help wanted columns with good results, and to show how much this page is read, I will cite a couple of examples which have come under my notice.

One time I was in a small manufacturing town in Ohio for a few days, and bought a copy of the "American Machinist" from the local dealer. Out of curiosity I asked the dealer how much business he did in one week with the "American Machinist." He replied that he had about fifteen regular customers who bought a copy every week, but that perhaps fifty men came in every week, the first day it was on sale, took up a copy and turned to the help wanted page, took note from there and laid the copy down without buying. Perhaps this does not show the best judgment on their part, inasmuch as probably every one of these men would receive fifteen cents' worth from the reading columns for their money, but it does show that the help wanted page is widely read by the very class of men whom the advertiser is anxious to reach.

Again, I have often noticed through how many hands a copy at the shop will pass, being borrowed on the day of receipt by many men.

The ads. should be definite and to the point, and should clearly state just what kind of a man is wanted in order to secure attention.

For instance, one ad. I saw in the "American Machinist" read: "Wanted—a draftsman, state age, experience and salary expected," and the advertiser might just as well have thrown his money away, for as there is an endless variety of draftsmen in the machinery line alone making a specialty of one certain kind of machine only. No man is going to take the time to write out a lengthy reply to such an ad. on the bare chance that the position advertised may be in his line, when he is a lathe designer, and the man wanted is one for mill construction layouts.

I believe also that advertisers will find it to be an advantage to let the name of the firm advertising appear in the ad. instead of using a box number, as it creates confidence in one answering the ad. that it will be given consideration.

Many men whom I know will not answer a blind ad., some foolishly thinking the columns are "salted" or, in other words, carry some fake ads. to fill out the columns, which impression, though erroneous, is heightened by the fact that some firms will not take the trouble to answer all applications sent them.

Another reason is the fact that perhaps the firm advertising is the same one for which they are working, and if their letter of application fell into the hands of their own company, they would more than likely be "fired" in consequence. I can see no advantage in this for the advertiser except in the case of one advertising in the Situation Wanted columns, where an entirely different consideration is present.

J. CARD.

Akron, O.

* * *

When sending replies to a box number in our care any reader can state the concerns to whom he does not want his application sent.

If the advertiser is one of these concerns the application is destroyed.

Under no circumstances can we divulge the name of any one advertising under a box number.

But we say it most emphatically, all advertisements in the "American Machinist" are bona fide.

* * *

Only reliable products can be continuously advertised.

Method of Making Dense Die Castings

By Ethan Viall

Details of die casting machines that produce castings of the same or greater density than the ingot.

How the double or balanced vacuum is obtained.

Testing the specific gravity of alloys and castings.

One of the great difficulties encountered by makers of die castings, has been the liability of the castings to be porous or full of air holes at the place where least desired. These blow-holes have been caused by air being confined in the mold when the melted metal entered it.

The general practice has been to exhaust the air as much as possible from the mold just previous to letting in the metal, but the vacuum created in the mold has caused some of the metal to spray into the mold from the melting pot, which metal seals up to a greater or less extent the vents of the mold. Then when the metal for the casting was forced in, there was air in the mold which had no place to get out, or if there was an opening for it, it was too small to let the air out fast enough, and blow-holes were the inevitable result.

In fact, considering the speed at which the metal for the casting is forced in, an opening almost as large as the gate itself would be needed to let the air out fast enough to prevent bubbling, in which case no vacuum of any description could be maintained.

In order to overcome the difficulties just mentioned, C. M. Grey, of the C. M. Grey Manufacturing Co., East Orange, N. J., some time ago invented a machine in which a double vacuum is used; a vacuum in the die and a vacuum back of the melted metal.

The two vacuums are evenly balanced up to the instant of filling the die, when the metal is forced in by compressed air, this plan preventing the "leakage" of air into the die, and consequently there is nothing in it to cause blow-holes when metal is cast in.

The Casting Machines

In order that the reader may have a clear idea of how this is done, we will proceed to illustrate and describe the casting machines in detail.

A general view of a row of the machines used in the Grey shop is given in Fig. 1. This gives a good idea of a model die-casting plant, the machines being conveniently arranged and set in such a way that the operators have plenty of room and light.

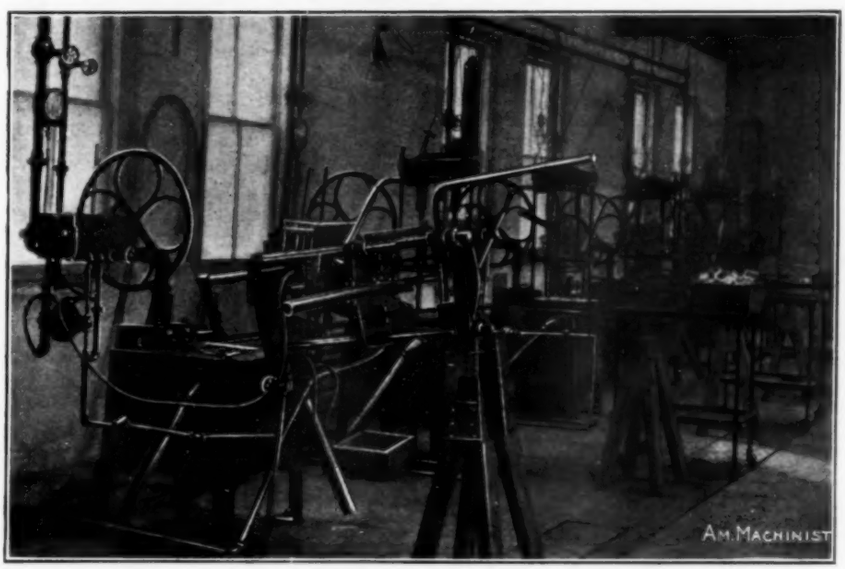


Fig. 1. Group of Grey Double Vacuum Die-casting Machines

A view of an individual machine is shown in Fig. 2, in which *A* is a die set into a carrier, which may be swung back when the die is to be opened for the removal of the casting; *B* is the lever which operates the lock used to hold the die carrier firmly down onto the top of the metal tank; *C* is the handwheel by which the operator governs the vacuum and air valves; *D* is a vent pipe for the products of combustion; *E* is the pipe to the gas heater used to melt the metal, and *F* are exhaust tubes connected to the die through which the air is pumped out.

Referring to the opposite side of the same machine, Fig. 3, the letters correspond, but with the addition *G*, which is the lever used to open the die; *H* operates the gate; *I* works the mandrel in a threaded part of the casting made in this die, and also forces out the ejector pins; *J* is the valve box; *K* is the vacuum gage and *L* is a vacuum equalizer containing a metal diaphragm, which is connected to valves leading to the vacuum pipes for both the die and the metal pot.

As the vacuum gains on one side, the diaphragm is pulled over; this opens the valve on the opposite side a little wider and allows the vacuum to increase, and *vice versa*, the action of the diaphragm automatically keeping up until the desired vacuum is attained equally on each side. The arrangement of the die and metal pot will be gone into in detail further along in this article.

One of the machines open, with the parts of the die separated, is shown in Fig. 4. The die carrier is counterbalanced by a cord and weight to make it easier to handle, and when thrown back rests on a wooden support, as shown.

The die shown here is different from the one illustrated in Figs. 2 and 3; the lower part is shown at *A*, the upper part being drawn back at *B* by swinging around the lever *C*. A part of the vacuum chamber for the metal pot is shown at *D*; *E* is the opposite end or spout of the pot, through which the melted metal enters the die when the carrier is in position; *F* is the supply tank from which the metal pot is replenished as the castings are made, the metal simply being dipped with a ladle from the supply tank and poured into the spout.

Details of the Double Vacuum

The line engraving, Fig. 5, shows the method of obtaining a vacuum back of the metal to be cast, at the same time a vacuum is obtained in the die. This engraving was taken from the patent specification, and while not exactly the same as the plan of the machines photographed, it serves to make plain the principles of the apparatus.

In this, *A* and *B* represent the two parts of the die body, and *C* the die cavity, shaped to form the casting desired; *D* and *E* are vents through which the air is exhausted from the die through the pipe *F*; *G* is the gate of the die which rests directly over the spout *H* of the metal pot *I*.

In actual practice there is a valve or plunger used to close the gate and shut off the melted metal after the die is full. The operation of this is familiar to die-casting operators, though not shown here.

At the end of the metal pot, opposite the spout, is a vacuum chamber *J*, to

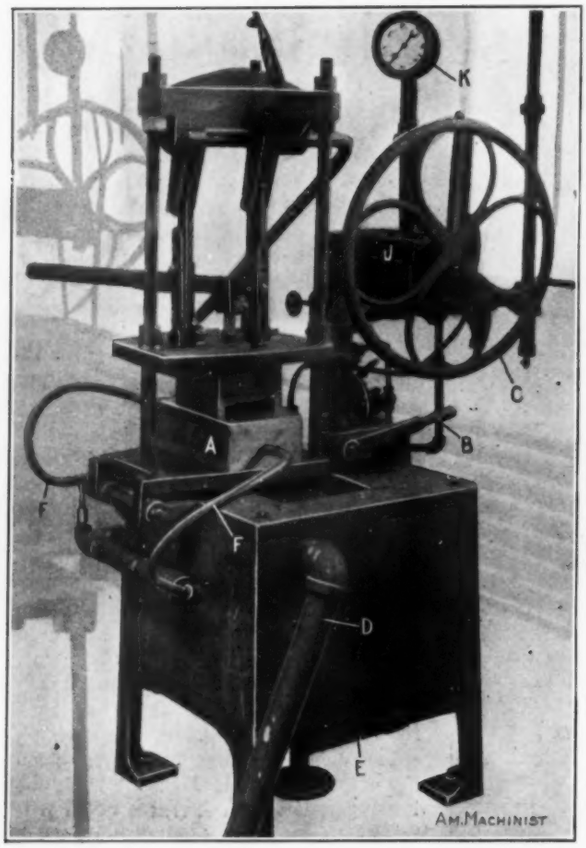


FIG. 2. A CASTING MACHINE READY FOR USE

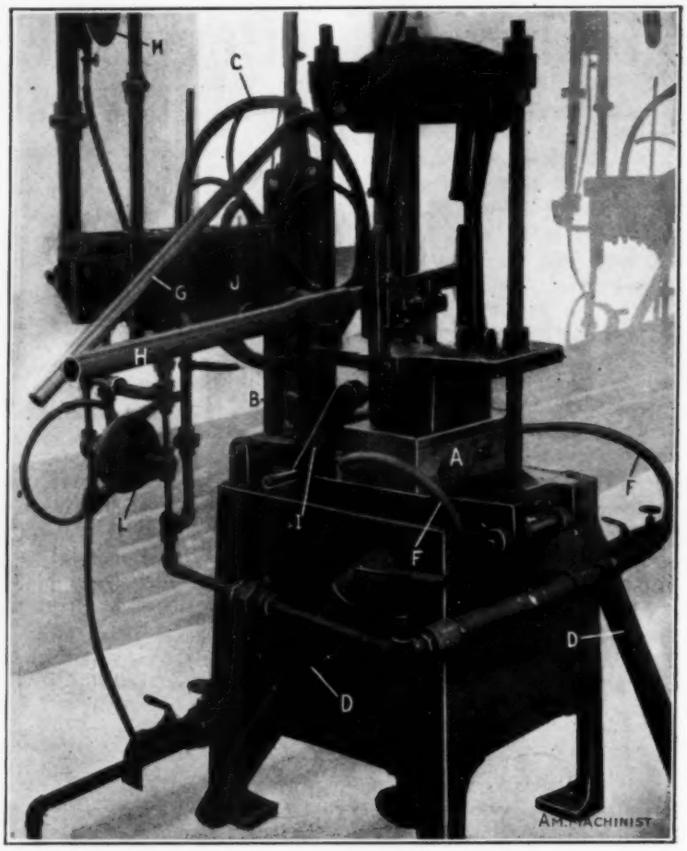


FIG. 3. OPPOSITE VIEW OF SAME MACHINE

which the pipe *L* is connected. This pipe not only connects with the vacuum pump at *M*, but also to the compressed-air pipe at *N*. The exhaust pipe *O* has two branches, *P* and *R*, which lead to the vacuum chamber of the pot and the die, respectively, through the valves shown in each branch.

The pipes *S* and *T* lead from the two exhaust pipes above the valves to chambers on opposite sides of the diaphragm *U*, so that excess of vacuum in either the metal pot or the die will cause the diaphragm to move toward the side on which the vacuum is greatest, partly closing the valve on that side and correspondingly opening the valve on the opposite side. In this way an equal vacuum is obtained on both sides of the melted metal and prevents the entry of air, gas or melted metal into the die, without the interposition of mechanical means.

When the balanced vacuum has reached the desired amount, as indicated by the gage, the suction is shut off at *M* and compressed air is instantly let in at *N*, which goes through the pipe *L* and forces the melted metal up into the die.

The method of employing a vacuum on both sides of the melted metal previous to casting, effectually prevents porousness or blow-holes in the castings, and a comparison of Figs. 6 and 7 will show the difference, though it is almost impossible to give a good idea in a halftone.

The broken castings, shown in Fig. 6, were taken at random from a lot made by the old process, and show not only a fine porousness all over, but large blow-holes in many places, some of which are noted at *A*, *B* and *C*.

The broken castings shown in Fig. 7 were made by the double vacuum process, and show a remarkably close grain and no blow-holes, though no care was taken to select good ones.

However, mere visual inspection is not relied upon to prove that these castings are as dense as the ingots from which they are made. As these alloy-ingots are cast in an open mold, with no chance to form blow-holes or be porous, the die-casting user cannot ask for castings of a greater specific gravity than the original alloy, though, as a matter of fact, the castings produced by the double-vacuum process are actually slightly more dense than the ingot, owing to the method of compressing the metal in the die.

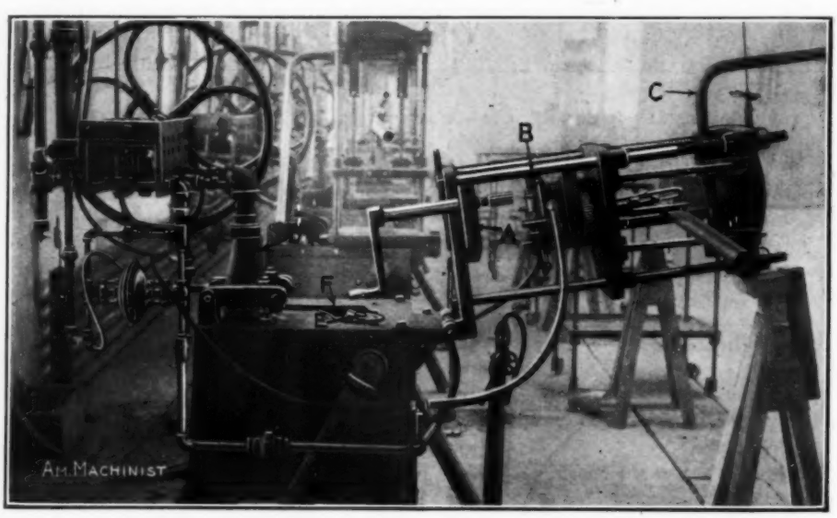


FIG. 4. DOUBLE VACUUM DIE-CASTING MACHINE OPEN

A Specific Gravity Machine

In order to test the specific gravity of the ingots and also of the castings, the device shown in Fig. 8 was made.

The tank *A* contains water, and the cylinder *B* is connected to it by a small pipe *C*. A piston is fitted into the cylinder, and may be moved along in it by means of the screw *D* and the geared nut *E*, operated by the gear *F*, which has a handle at *G*. The cylinder and screw are so proportioned that one turn of the geared nut moves the piston forward to displace exactly one-eighth of a cubic inch of water. The collar *H* on the geared nut is divided into 125 equal spaces, and there is a pointer at *I*, which indicates 0.001 cu.in. for each graduation.

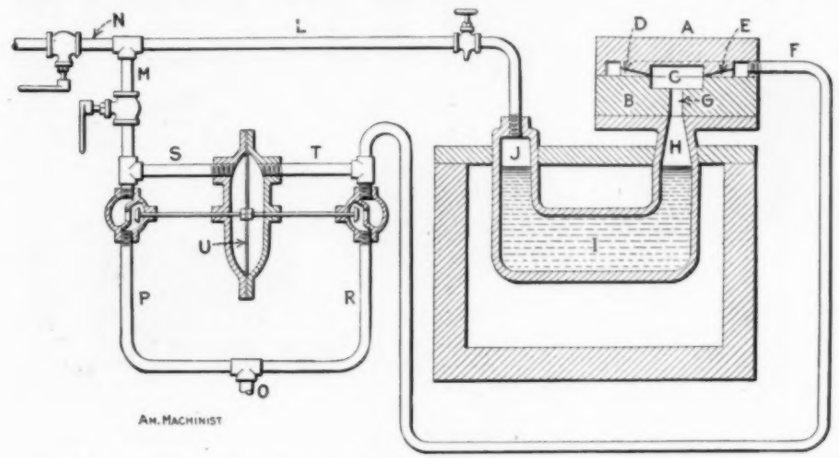


Fig. 5. Method of Obtaining the Double or Balanced Vacuum

The two gears are equal in diameter and have an equal number of teeth, and each graduation on the scale *J* equals the threads on the screw *K*, so that each complete turn of the handled gear *F* displaces one-eighth of a cubic inch of water in the tank and also moves the pointer *L* along one division on the scale *J*.

The cover *M* has a mercury seal around the edge and is held down by the rod *N* and the springs *Q*. At *P* is a glass tube with a graduate mark on it to measure the height of the water. A plug *R* may be screwed up or down, when starting measurements in order to bring the water up to the mark in the tube coincident with the zero marks on the scale and the graduated collar.

In starting to determine the volume of a piece of metal, the piston in the cylinder is run out to within about an inch of its outward position, the tank is then filled with water above the level of the mercury seal, then the piston is drawn out until the water falls below the level of this seal, when the cover *N* is placed on the tank and secured against displacement by the spring holder.

Fig. 6. Castings Made in Usual Manner, Showing Blowholes

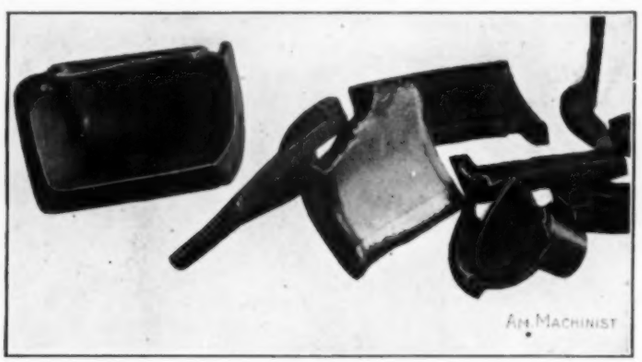


Fig. 7. Castings Made in Double Vacuum Machine

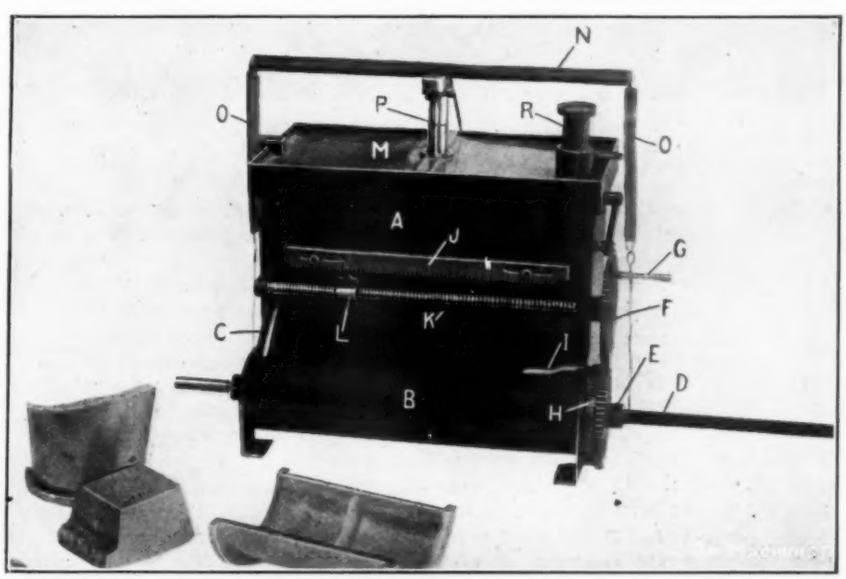


Fig. 8. Apparatus for Testing Specific Gravity

The piston is then forced inward, and when the water shows near the line on the tube *P*, the dial *H* is set so that zero coincides with the pointer *I*; then the displacement screw *R* is run up or down so as to bring the water exactly to the line on the tube *P*. The scale *J* is then moved until zero coincides with the position of the pointer *L*.

After the setting is complete, the piston is again run back and then after the water has been run below the level of the mercury and the cover *M* raised, the piece, whose volume is to be measured, is lowered into the tank by means of a waxed thread which goes through the center of the tube *P*. The cover is again placed on the machine and the plunger forced inward, then when the water shows level with the line on the tube *P*, the

reading is taken from the scale *J*, which, as before noted, is graduated in eighths of an inch. The figure taken from the scale is read to the last eighth mark which the pointer *L* has passed and then to this is added the number of thousandths shown on the dial *H*. The sum of these two readings gives the volume of the piece being measured.

The plug that shuts off the metal in the gate is not shown, but it is operated by the long lever shown on the top plate of the die carrier in the previous halftones.

The Toolroom

A great deal of the work of a die-casting shop is carried on in the toolroom, which, owing to the accuracy of the dies, must be of the best. A view of the toolroom in this shop is shown in Fig. 11. On the extreme left are two Brown & Sharpe grinders, to which dust hoods are attached; the dust is carried off by an unusually effective exhaust system.

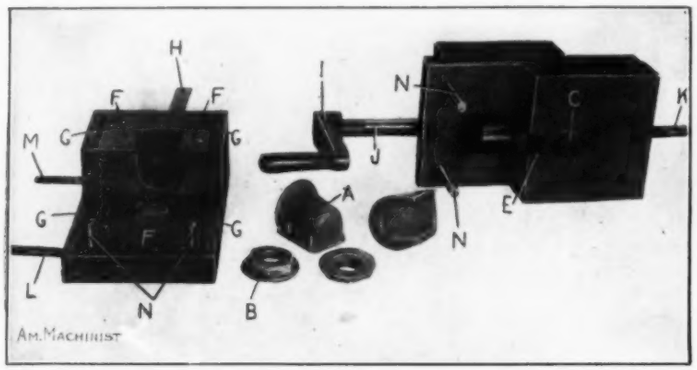


Fig. 9. Die for Casting Parts of a Switch

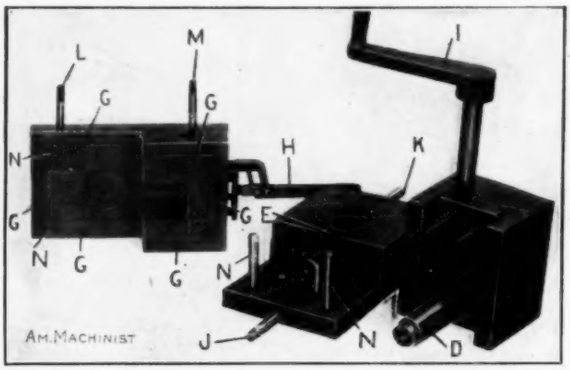


Fig. 10. The Die Partly Disassembled

The weight of the bar having been taken and the volume having just been obtained, it only remains to divide the former by the latter to get the weight per cubic inch. If this weight be again divided by the weight of water at the proper temperature, the specific gravity of the alloy or casting is obtained. In its use in the factory, they stop at the weight per cubic inch of the casting or alloy.

It will easily be seen that if the specific gravity of an ingot is determined before casting and also the specific gravity of the castings made from it, a definite basis of comparison is obtained. As a matter of fact, castings made by the new process average close to 2 per cent. greater density than the ingot, while the ordinary castings run from 4 to 6 per cent. less.

The Dies

The dies used do not differ materially from those in common use and so will not be gone into in detail here, though the dies for casting two parts of a switch are shown in Figs. 9 and 10, the former showing the parts just as they were removed from the machine, and the latter partly disassembled.

The parts cast are shown at *A* and *B*, and the mandrel for the threaded hole in *B* is shown projecting at *C*, and in the second view at *D*. The gate is at *E* and air is sucked out at the clearances *F*, which are 0.01 in. deep, and channels *G*. The lever *H* operates the ejector pins for both castings and the handle *I* is used to run out the mandrel *D* in order that the threaded casting may be more easily removed.

The pipes *J* and *K* are for suction-hose connections, and *L* and *M* are for water circulation. Dowel pins are shown at *N*.

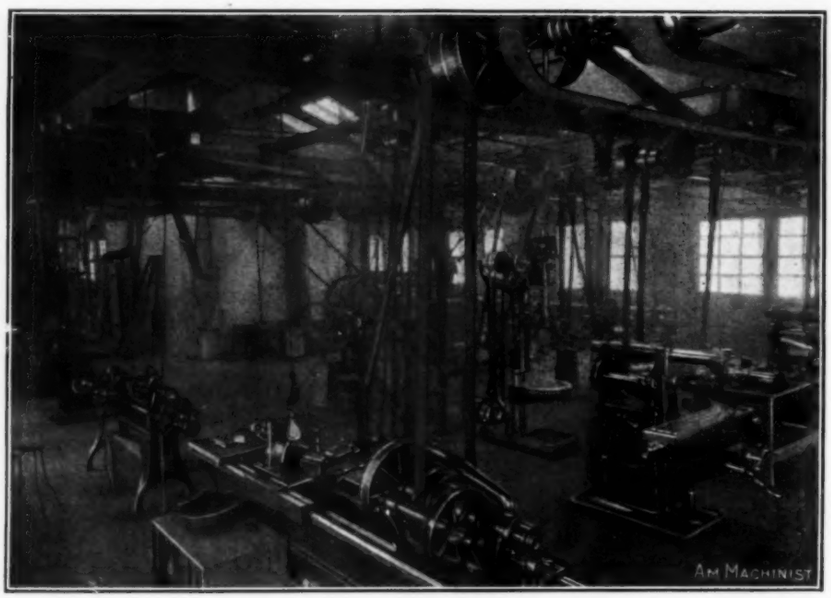


Fig. 11. General View of the Toolroom

In a paper recently presented before an engineering body in Detroit, Mich., Monroe W. McGrath, president of the American Steel Belt Co., of that city, presented some interesting data on the subject of steel belts. Mr. McGrath pointed out the rapid advance steel belts were making in Germany and cited several examples where steel-belt drives had effected large savings in both initial cost and upkeep.

U. S. Government Specification for Portland Cement

Under date of May 1 the National Bureau of Standards issued a circular, No. 33, giving the United States Government specification for portland cement. By executive order of President Taft all portland cement purchased by any department, bureau, office or independents establishment of the government, or to be used in construction work in connection with any of the branches of the government service, must conform in every respect to this specification.

The committee that prepared was it composed of engineers appointed by the various departments of the government. In the progress of their work they conferred frequently with representative consumers and manufacturers, as well as with special committees of the national engineering societies more directly interested in the subject. Copies of this circular may be obtained by addressing the Bureau of Standards, Washington, D. C.

The Principles of Management

By A. Hamilton Church and L. P. Alford

An earnest attempt to discover and declare the basic regulative principles of management, with special reference to the shop and factory. The principles are:

The systematic use of experience.

The economic control of effort.

The promotion of personal effectiveness.

This article is intended as a contribution toward the fixing of a systematic basis for a definite art of management. It does not pretend to be either a dogmatic or a final statement of details. The stage which has been reached by the art of management is the outcome of a slow evolution during a period of at least 150 years.

The division of labor has been a well recognized principle since the days of Adam Smith, in the middle of the eighteenth century. The detailed study and analysis of processes began with the factory development of the textile trade, and had reached a high state of evolution by 1832, as recorded in the writings of Charles Babbage.

The considerable expansion of manufacturing operations during the last 20 years, owing to the enormous international commerce fostered by the steamship and the telegraph, and the uprise of an unprecedented civilized community of 100,000,000 people in America, has introduced much more complex problems than were known to the manufacturers of the nineteenth century, and has rendered the settlement of the art of management on well defined principles a matter of very great importance and urgency.

Many notable contributions to the question have been made of late years, yet it is not too much to say that their authors have been more occupied with urging special systems on the attention of the industrial world, than in developing the skeleton of a real scientific art of management.

In other words, many *solutions* of the problem of management have been offered, representing personal points of view, but these solutions are merely empirical combinations of methods, some good, others of distinctly doubtful value, and their importance is based rather on the authority possessed by their authors than on close logical reasoning.

Management is very far from having attained the dignity of a science at the present time. Yet it has progressed sufficiently for an orderly, though strictly tentative, statement of fundamental principles to be highly desirable. The logical development of these principles to the point where they touch practice may also be undertaken, and in the present paper this is all that is attempted.

The search for fundamental principles is, of course, of great practical importance. They would bring to light the gaps in our knowledge, and focus attention on the weakest links in our chain of practical applications. The mapping out of related fields of activity would become possible, so that every proposed improvement in method could be seen in its relation to the whole—a condition absent at the present time.

In Vol. 36, page 612, Congressman W. C. Redfield ably outlines the present situation and need thus:

> But there has not yet been established a science of management. And yet, if a science were ever needed, meaning definite rules or principles, based on exact knowledge of facts, it is in this very matter of management.

No apology is therefore necessary for an attempt to formulate some definite basis on which to build a truly scientific art of management. The regulative principles of the art of management are three:

The systematic use of experience.

The economic control of effort.

The promotion of personal effectiveness.

If these three principles are correctly stated, then the scientific basis of management is capable of being derived from their development and extension.

The First Principle—The Systematic Use of Experience

Experience is the knowledge of past attainment. It includes a knowledge of *what* has been done, and also *how* it has been done. It is inseparably associated with standards of performance, that is with the ideas of quantity and quality in relation to any particular method of doing something.

The great instrument of experience, which makes progress possible, is "comparison." By systematic use of experience is meant the careful analysis of what is about to be attempted, and its reference to existing records and standards of performance. In many cases it may be found that gaps in existing experience occur. In such cases the experimental determination of data may be undertaken, so that we have a full covering of the ground, either by the experience of others or from our own experimental determinations.

In setting out to examine any work it is necessary to ask:

What experience, in the form of methods and standards of performance, already exist?

Is our performance equal to these standards?

Is it so far behind that it will pay to expend time, energy and money to approximate more nearly?

Are existing standards based upon the use of the most advanced practices and methods of the present day, or is there reason to suppose that experimental redetermination of such standards would show a new maximum of effectiveness?

In the experimental accumulation of experience the economic value of such experience must be kept in view. If the inquiry relates to operations which will be repeated many times, as in the processes of manufacturing staple articles, detailed experimental investigation may be worth while. In other cases it is well to consider the total economic value involved, the possible maximum that could be saved, and the probable cost of the investigation.

Experience tends to pass into traditional practice. That is its most useful form. Every kind of experience must pass into the mind of a man before it can be utilized practically; hence it follows that new experience should be crystallized into new traditions of practice as fast as possible.

In the shop, men are not always running to textbooks to see if they are right—at least the competent practical man is not. Even if it be conceded that practice in the present day is all wrong, and needs to undergo exhaustive study and reform, this only means that we are engaged in developing new standards of practice, which will take the place of the old traditional practice, and will in turn, form a new tradition. The proper place for these new traditions or standards of practice is precisely the same place as where the old ones were kept, namely, in the minds and memories of those who do and are responsible for doing the work. Further, it is impossible to record it all—something must remain with the man.

New experience can be transmitted in one of two ways, either in minute instructions of which individual workers do not perceive the drift, or as a connected body of new practice. The latter form is the better, though it demands educational efforts somewhat apart from ordinary shop routine. Not until the new experience has become fixed as a habit will its full value be realized.

The Second Principle—The Economic Control of Effort

Effort is experience in action. Before we can do we must think, that is, dig into our stores of experience relative to

the proposed undertaking. Having taken thought, we proceed to action.

In order to produce organized action it is necessary to control effort in various ways. These are, "division," "coördination," "conservation," and—in industrial undertakings — "remuneration." Most of the discussions about management are, in fact, discussions about the various methods and degrees of controlling effort and fixing its reward.

It is possible to manipulate effort so as to produce an organization of the utmost flexibility or on the other hand, one of hard and fast rigidity. In certain special cases, rigid organization is permissible, but in general manufacturing, flexibility is really essential.

By flexibility is meant the power of self-adjustment to unforeseen events.

The divisions, "coördination," "conservation" and "remuneration of effort" will now be considered in the succeeding paragraphs.

Division of Effort

Division of effort is largely controlled by design. This is the principle of the unit part or component. Modern practice regards the complete machine or device as an aggregation of parts, and it is one test of efficiency when these parts come together in perfect shape, without requiring readjustment to correct faults of workmanship in their progress through the shops.

In modern manufacturing, design cannot be considered apart from operation. Not only must the exigiencies of shape and dimensions with a view to economy in molding and machining be kept in view, but reduction of work by means of jigs, fixtures, etc., must be kept in mind. Usually also, standard dimensions, or fits, are a controlling feature in design.

All types of management are pretty much in agreement as to design. Concentration of attention on the unit part may be regarded as settled practice. There are, however, two important ways in which subsequent activities are built up. In one case the drawing sets things in motion; in the other case the model does it. Even a small characteristic like this tends to produce some variation in the type of organization, but consideration of these variations must be postponed.

It will be evident that design is a wholly independent function. It may be efficient or inefficient, quite apart from other functions. We may have very high efficiency of operation, for instance, and very poor design, or *vice versa*. As we proceed we shall see that all manufacturing operations consist of the combination of this with several other functions—all of which are independent, and contribute their quota of efficiency or inefficiency to the total result.

"Division of effort" is an universal principle throughout all the activities of manufacturing. Starting with design, which controls the maximum limit of operative division, it is usually found desirable that operation should also be divided into processes. These usually correspond to machines. To some extent they are controlled by "settings."

It is important to have as few settings as possible, as nothing else is so wasteful of time. One setting in a jig is, therefore, made to subserve several processes in some cases. In other cases one setting in a machine holds the work for a series of consecutive processes, which may be of a different character, as turning, boring, threading, etc., at one setting.

From this it is apparent that there are limiting considerations to the division of effort. It is not merely a question of dividing to the bitter end. There are cases in which it is better to combine operations, and in fact execute them simultaneously.

This is worthy of attention, because it will be found that in all the principles of management that have yet been ascertained the limiting conditions are not yet formulated. Every such principle has limitations and it is neither necessary nor advisable to push it to its farthest possible development. For example, the provision of jigs for repetition work and where it is required to secure dimensional relations of exactness, as in driling holes, though a very old idea, has not yet been definitely settled as regards its limiting conditions, and there are frequent cases in which doubt exists whether the expenditure for such jigs was after all, a wise one.

By many of the enthusiastic advocates of particular systems of management, the existence of limiting conditions is hardly suspected, consequently they ride their favorite hobby to exhaustion, till many useful ideas become discredited in the eyes of practical men. It is not enough to know that a principle can be applied—it is even more important to know when not to apply it.

Management cannot substantiate its claim to be a science until all these problems are cleared up. At present, it is not too much to say that very few of the problems of management have been recognized and defined, much less settled. Much of the present clamor is actually leading attention astray from the true essentials of the science of management.

The third great field of division of effort is in connection with administration or control. This is the great battleground of the systems at the present moment. Thus, to mention only two, we have Taylor's functional system, and Emerson's line-and-staff plan. Also we have the old method of simple, delegated authority in hierarchical form, from president to manager, manager to superintendent, superintendent to foremen and so on. Which is the best?

Obviously, the question cannot be answered until we have ascertained what principles have been applied in each case to produce these forms of organization, and what are the limiting conditions that control, or should control them. The subject is a tempting one, but it must be postponed until, at least, the remaining modes of manipulating effort have received attention.

Co-ordination of Effort

The coördination of effort is an inseparable counterpart of the division of effort. By coördination is meant the prearrangement of a number of separate efforts in such a manner as to produce a definite end. A still more perfect coordination is attempted when this end is to be attained in a definite time. Coordination in design means that unit parts are so designed that, ultimately, they fit together. Coördination in division of operations means that when all the operations are performed certain definite shape and dimension are given to the part. Both kinds of coördination are part of everyday practice, and are generally realized with a good percentage of success. Coördination of operations in regard to time, is however, a more advanced matter, and in many plants is still in a very unsatisfactory stage.

The coördination of administrative effort is the most complex and debatable problem of all. The moment we begin to divide effort, we must also begin to provide for its coördination. Administrative effort does not possess the same tangibility or definiteness as do design and operation, because it is wholly made up of spheres of influence of personal authority.

Therefore, in proportion as we divide administrative effort (executive functions) its coördination becomes more difficult. The more we subdivide authority the less flexible becomes our organization.

There is a point midway between simple delegation of all authority and the method of analyzing it into component functions and handing out each of these functions to a separate man, that is probably the most effective way of dividing administrative effort. The limiting conditions to excessive functionalism can, however, already be seen as shown above.

Conservation of Effort

Effort requires not only to be divided and coördinated, but also conserved. The conservation of effort means proceeding along the line of least effort to attain a given end.

In regard to design, the conservation of effort implies standardization of parts. In regard to operation it implies standardization of tools and equipment. In regard to administration it means using

only so much complexity of system as is absolutely necessary. The conservation of effort, though of very great practical importance, is so simple an idea that it hardly requires either emphasis or illustration, at this stage.

Remuneration of Effort

The remuneration of effort has very little relation to any of the other manipulations of effort, for these would still be necessary if no remuneration was offered at all. But as no plants are manned with staffs who work for the mere pleasure of working or "for their health," the question of remuneration, is very important.

The Function of Comparison

It has already been remarked that the great instrument of experience is comparison. In practical matters, this is also a department of effort, and requires as careful treatment. It includes the comparison of actual product with set standards commonly termed "inspection," comparison of results as expressed in figures of various kinds, including works statistics, and cost accounts, as well as the accumulation of data of the efficiency of individuals with a view to justice in promotions.

Design is at the beginning of the chain of production and decides what is to be done. Comparison is at the end of the chain and records what has been done, and also in some cases decides whether it has been done according to design. The effort, or activity, devoted to comparison is, of course, subject to the general law of effort, and requires division, coördination, conservation, etc., just like other branches of activity.

Although somewhat intimately connected in many cases with the mechanism of administration or control, it must be clearly perceived as a quite different kind of activity. Administration sets and keeps things going. Comparison merely records the results. The distinction is important, because it is quite possible to have an excellent system of comparison, and a wretched system of administration, and *vice versa*. Comparison is, therefore, one of the independent functions of manufacturing activity, and its efficiency is not inter-related with that of other functions.

The Third Principle—The Promotion of Personal Effectiveness

The ideal plant is one which has good equipment, good methods, and good men. It is a comparatively modern discovery that the welfare of the plant and the welfare of its employees are closely connected. By welfare, we do not mean however, the semi-philanthropic ideals which result in model villages and other "social welfare" experiments, but only the application of the principle of the "square deal" to working relations during working hours.

The Latin poet defined happiness as the possession of a healthy mind in a healthy body. The definition is perhaps a somewhat pagan one, but eminently practical at that. If the plant cannot secure these gifts for its people, it can at least see that all conditions shall be favorable, or at any rate, that they shall meet few conditions in their working hours inimical to either health of mind or body.

Remuneration stands, of course, at the head of these conditions, but it is not the only one, nor does it stand unconnected with others. In spite of Thomas Carlyle the "cash nexus" is far from being the only link between employer and employee, even today—that is, if he is wise. In every considerable organization *esprit de corps* is always latent, and if it remains latent or is turned into latent, or open, discontent it is a mark of the very worst management.

Every human being desires to feel that his work is important. Even the criminal frequently has pride in his criminality. With certain kinds of creative work the mere doing of it is associated with a high degree of personal satisfaction, because the author or the artist is only following out the law of his being.

The worst enemies of progress and contentment are those who are always crying from the house tops that mechanical work is dulling to the intellect, that men are becoming machines, and so on. It is a shock to any man to hear that his work is unimportant and destructive of the higher faculties. It may be so in certain cases, but it is not necessarily so. That largely depends on circumstances. The control of such circumstances is to some extent in the employer's hands.

Considered on the lowest platform the subject is one of importance, since all errors of policy have to be paid for, whether by an individual employer, or, in the case of a general practice, by the industry as a whole. It is one of the most hopeful signs of modern times that these matters are being actively discussed from many different points of view.

In proportion to the number of elements in a problem the difficulty of its solution augments. Personal effectiveness, and its favoring conditions, contain innumerable elements, many of which probably defy human analysis. Therefore, we must proceed modestly and cautiously on the path of discovery, and far from attempting to lay down the laws, it will be well if we succeed in observing the interplay of a few of the most obvious conditions of personal effectiveness.

To begin with, we must assume physical health. From this it is but a step to recognizing that shop conditions must be such that health can be conserved. This point is beginning to be understood, and modern shops avoid the dirt, darkness and obscurity and extremes of cold and heat that a generation ago were accepted as good business. We have progressed so far as to be aware that, on the contrary, they are very bad business. Closely allied is the question of affording facilities for personal cleanliness, dining halls for the midday meal and other auxiliaries to physical needs of shop existence. The most widespread application of this third principle today is in the safeguarding of machines and operations.

The real center of the problem, is, however, not on the physical plane, or only incidentally so. The physchological elements are not so obvious, but they are much more important. As in most of the analyses we have made, it is observable that these two groups are nearly independent of one another; that is, their efficiency can vary independently. We may have very bad physical conditions and yet a fine *esprit de corps* or, on the other hand, a finely arranged modern shop and a sullen, discontented population within its walls.

The independence is not quite complete, since bad physical conditions must affect the psychological side to some extent, even though not observably. But on the other hand, the finest psychological adjustment will not make a dark shop light, or a cold shop warm.

Some of the conditions of personal effectiveness are these: The individual must feel leadership; have adequate encouragement and reward; be physically fit and under good physical conditions; and receive a definite allotment of responsibility.

These conditions apply not only to the operative force but to all grades of employees. In fact, some of them apply with greater urgency to the man "higher up" than to the actual worker. It is evident that they have, or should have, a considerable and controlling influence on the arrangements made for the division and coördination of administrative effort.

A good deal has been made by some of the modern schools of management doctrine of the claim that this or that system creates a fine spirit of coöperation between the plant and its men, but for the most part these claims are merely statements of a desirable end to be attained, and not indications of a method by which it can be attained.

The truth is, of course, that no single element of a system, or even a combination of half a dozen such elements, as methods of payment, functionalized authority, etc., more than touch the fringe of the question. Highly organized systems may coexist with fine *esprit de*

corps, but the latter is not dependent on any form of system or organization.

Of all the conditions controlling a fine working atmosphere, leadership probably plays the most important part. In warfare men prefer to serve under the general who wins battles, though that entails hardships without number and toil without end. In industralism, mechanism is a mighty unimportant thing compared with an "old man" who is a born leader of men.

The weakness of one prominent school of management doctrine is that it pretends that it has superseded leadership, by substituting therefor elaborate mechanism. Such a contention betrays a complete misapprehension of how men are constituted, and of what the true functions of elaborate mechanism really are. All such mechanism is but a collection of mechanical tentacles or feelers, to enable the controlling mind and spirit of the management to be in several places at once. If the personality behind these tentacles is a feeble one, the mechanism will not supplement its deficiencies in the slightest degree.

This is not to say that such mechanism is useless; on the contrary, it is essential in the large-scale operations of modern industry, and it is, therefore, highly important that it should be carefully arranged and well balanced, but it is in itself inert and lifeless—a purely passive channel through which the capacities of leadership may exert themselves.

A favorite illustration of the folly of "perpetual motion" is the reflection that a pound will not lift a pound anyway, and that the chances of making it do so are not increased by putting gears, levers, and other mechanism between the first pound and the second one, however artfully and plausibly these may be arranged.

The same truth applies to the mechanism of the organization. All work is born of effort, and all effort is controlled by the personal reaction of one man on another; therefore it is evident that no greater results can be attained by putting a vast array of blanks, forms, cards and books between the first man and the second, however plausibly and artfully they are arranged.

In other words, organization and system are something forced on us by the necessities of the case, and that something has no virtue either in itself, or in any possible combination of its components. It does not add one single cubit to the stature of leadership, though on the other hand, its absence, or its bad arrangement may detract considerably from the full realization of what would otherwise be possible to leadership.

It is more than probable that types of organization depend for their success on their harmony with the particular type of leadership that is endeavoring to make use of them. This would explain why systems are successful in one case and fall down in what appears a similar case.

At the present stage of the analysis of management we can do no more than make a note of this. It must always be remembered, however, that organization is a tool, and that it is our duty to fit it to the leader, and not try to compress the leader to fit the system. Understanding of the limiting conditions of this part of the problem must be left to future progress to compass.

Recapitulation

This necessarily highly condensed and skeleton outline of the main regulative principles of management must end here. It will be observed that we have enumerated three regulative principles dealing respectively with "experience," "effort" and "personal relationships." Effort is further subject to certain modes of action; namely, "division," "coördination," "conservation" and "remuneration." This action is applied in certain definite divisions: "Design," "administration," "operation" and "comparison."

The truth or error of these expansions of the three principles must rest on the idea that each of these subdivisions is independent of the others. One can have good division with bad coördination; a high degree of conservation with a faulty basis of remuneration. Similarly the practical applications are also independent. Good design may coexist with every subsequent inefficient element. Operation may be, and commonly is, well in advance of methods of administration. All these may be good, and yet the remaining function of comparison may be only rudimentary.

These considerations point to the fact that *these are not arbitrary or accidental classifications, but are really fundamental,* and can be used in the practical analysis of the activities of any business. Improving one of them does not improve the other, and may even in some cases be wholly wasted effort. This latter consideration shows why reorganizations sometimes fail of effect, and general efficiency is not improved.

Finally we have dealt cursorily with the question of personal relationships. In their very nature these are more nebulous and difficult of precise definition, yet the conditions of personal effectiveness enumerated also pass the test of independent functioning, inasmuch as any one of them may be at a maximum while the others are lower in the scale, or practically nonexistent.

It may be interesting to subjoin here a brief comparison of the chief principles put forward by Taylor and Emerson, and show their place in relation to this tentative attempt to formulate the fundamental and constructive principles of management.

Mr. Taylor's Principles

As pointed out in Vol. 35, page 108, in an article entitled "Has Scientific Management Science?" Mr. Taylor's "scientific management" is a collection of axioms and an arbitrary combination of specific mechanisms rather than a body of principles. Among its leading features, time study, functional foremanship, standardization, planning in advance, and task-bonus may be selected as characteristic.

The place of time study is obviously under the first principle; namely, the systematic use of experience. It is a tool for supplementing and extending our experience, and its economic limitations have been discussed under that heading. Functional foremanship is related to the principle of the economic control of effort, and particularly to the division of administrative effort.

Standardization belongs to the same principle, and its particular niche is under the head of conservation of effort, in an avoidance of complexity where uniformity and simplicity can be maintained. In reforming old industries, standardization usually means cutting down, but in new industries it means the avoidance of unnecessary kinds, sizes and methods. It means building up along the lines of least effort—either result flowing readily from acceptance of the sub-principle of the conservation of effort.

Planning in advance is largely an application of the coördination of effort. A certain amount of planning is inherent in every established routine, because the very idea of division of effort necessarily implies some measure of coördination. The necessity for preserving flexibility acts as a limiting condition to planning too elaborated and intensive.

Task-bonus is, of course, a special variety of application of remuneration of effort. Its value as a practical device must rest upon the degree to which it actually promotes personal effectiveness. It is one of many methods of remuneration, but the conditions to which this and the other methods apply in the most effective degree have not yet been studied and compared in any serious way.

One more point of Taylor's system may be mentioned. It is his claim that the science which underlies each act of each workman is so great that no workman is able to fully understand it (and presumably give it effect) without specific and very detailed guidance from above. This point has been covered by what has already been said on the subject of forming new traditions and habits based on the new knowledge that recent progress has given rise to.

This is obviously a case of applied systematic experience. If Mr. Taylor had in mind the use of his slide-rules in making this claim then it is obvious

that the use of such slide-rules, where they are useful, should become as much a part of the man's working habit, as is the use of shifting gears or other devices for controlling the working of the machine.

Mr. Emerson's Principles

Emerson's twelve principles will not detain us long. His first principle, "clearly defined ideals," is not especially an industrial principle. It is presupposed that a man knows what he wants, or he can do nothing successfully. It certainly comes, however, under the head of systematic use of experience, if we try to apply it practically. His second principle, "common sense," is hardly a principle at all. It is simply one of the basic conditions of all successful human endeavor, and might be ranked with "sound judgment," "perseverance" and other moral and mental attributes. It is not especially industrial.

His third principle, "competent counsel," must also be ranged under the systematic use of experience. It means from those best qualified to provide it. His fourth principle, "discipline," comes under the division of administrative effort.

One of the prime functions of administration is to secure discipline, that is, to prevent irregular activities which are not coördinated with the useful activities necessary to the work. Idleness, absence, disregard of instructions are examples of uncoördinated, and, therefore, harmful effort.

The fifth principle enunciated by Mr. Emerson is "the fair deal." This is a psychological matter belonging to the promotion of personal effectiveness. His sixth principle, "reliable and immediate records," is, of course, the function of comparison spoken of, though not the whole of it. The seventh principle, "dispatching," comes under, and in fact is, the practical mechanism of, the coördination of effort. The eighth, ninth and tenth principles, "standards and schedules," "standardized conditions" and "standardized operations," have been discussed under the Taylor system; so with the eleventh, "standard-practice instructions."

In these four cases standardization means conformity with the principle of conservation of effort, while standard practice instructions are a part of planning, and therefore of coördination of effort. Finally we have the twelfth principle given by Mr. Emerson; namely, "efficiency reward," which is simply another phrase for "remuneration of effort."

These illustrations have been made to demonstrate that as far as can be seen at present the three fundamental principles formulated in this paper, with their derivatives, do actually find a place for all divisions which modern analysis of industrial working has brought to light.

The important point is, of course, that by stating and fixing what are believed to be the three basic and fundamental principles of industrial activity, and deriving the subordinate details from these in logical order, a beginning has been made toward finding a truly scientfiic basis for the art of management, on which all its prime facts can be built up, later, into a coherent and understandable system of theory and practice.

A Gage Cabinet

By E. A. Thanton

A convenient gage cabinet in use in the toolroom of the Wheeling Mold & Foundry Co., Wheeling, W. Va., is shown in the halftone.

A Gage Cabinet

The lower part contains shelves for various fine gages, while the upper part forms a table for a measuring machine which was made in the shop. It consists of a T-slotted bed *A*, on which are mounted two sliding brackets *B* and *C* into which two micrometer heads are set. Accurately ground and lapped space rods of various lengths are provided, which may be laid on the movable V-blocks, shown at *D*, and the heads accurately set therefrom.

The ends *E* and *F* are hinged and may be swung upward, and the top and front pieces *G* and *H* brought down over them, closing in the measuring machine. The bolt *I* fits down into the eye *J* on the lower door, so that one padlock locks the whole cabinet.

Over 300 vessels are now afloat or under construction propelled by Diesel oil engines. This number includes 115 submarine torpedo boats, 30 other naval vessels, and a number of freight and passenger merchant vessels of 1200 to 3000 hp. The United States lags behind all other industrial nations in the adoption of this engine for marine, naval and stationary use. France has over 60 submarine boats equipped with this engine. The United States has two just completed. The Diesel engine can use not only petroleum oils but tar oils, and oils produced by the distillation of lignite and shale. It has the highest fuel efficiency of any commercial heat engine.—*Engineering News.*

Chills for Metal Bedstead Brackets

Editorial Correspondence

Special fixtures for holding parts of metal bedsteads while casting the various brackets in permanent molds or chills.

Details of chills used in casting rail brackets for both large and small posts. Method of casting the ends on the side rails and the way the tongue is formed.

Few molders or machinists are familiar with the method of manufacturing all-metal bedsteads, especially as to the manner in which the cast-iron brackets are attached.

The main frames for the head and foot of a metal bedstead may be made in a number of ways. The posts may be separate pieces held together by cross-rails or rods, the combinations being almost infinite, or the main frame may be made of a single piece of heavy tubing bent in a form, as shown in Fig. 1. In this halftone the frame with its accompanying cross and vertical rods is shown clamped in the chills of a casting fixture, in which it is held while pouring the metal into the bracket molds or chills.

In this particular case there are 20 chills on the casting fixture, 2 for the rail brackets at *A* and *B*, which are shown open, and 18 for the smaller brackets that hold the small rods in place.

Trunnions on each side of the framework of the fixture allow it to swing on the supports *C* and *D*, so that as soon as the metal is poured into the chills, they are opened, the frame removed and the fixture swung into a horizontal position, ready for the assembling of another frame, the fixture being held up by two eye-rods, one of which is shown at *E*.

The frame being assembled in Fig. 2 is much simpler than the one just shown, requiring only 9 chills, though the upper ends of the vertical rods are held in holes drilled in the main frame.

It will be seen by examining these two halftones that the casting fixtures are adapted to a number of styles of bedsteads, as the chills may be aranged to suit.

Casting Rail Brackets

The bedsteads described are made by the Heron Iron Bedstead Co., Chattanooga, Tenn., and have a special rail bracket of their own invention, which does not require a ferrule of metal to be cast around the post in order to hold it on.

This special rail bracket is shown at *A*, Fig. 3. A slight amount of overflow metal is shown at the corners next to the post, but this is thin and easily broken off without damaging the bracket in the least.

The way these brackets are fastened is to drill two holes in the post as shown at *B*; then a handled form *C* is run down inside of the post from the foot, and wedged in place just back of the two holes. Next the mold is closed and the metal poured through the gate *D*, the result being a bracket, as shown at *A*, held to the post by a solid head of cast iron on the inside.

The handle of the form *C* is made of a piece of angle iron so that it is easily placed in position and securely wedged, a stop-pin *E* being used to regulate the depth on the standard sizes.

It will be noted that the chills *F* and *G* have already been poured, leaving the rail bracket for a separate run, which is done to allow for trouble that would otherwise be caused by expansion. It is often necessary to cast the cross-rod brackets of complicated designs in separate operations for the same reason. In this case a number of cross-rod clusters is run out and allowed to cool, after which the clusters are assembled into the main frames.

Owing to the taper shape of the slot in the rail bracket, the iron block, or core, used for it is made separate from the rest of the chill, so that as the chill

FIG. 1. BEDSTEAD AND FIXTURE IN POSITION FOR POURING THE CHILLS

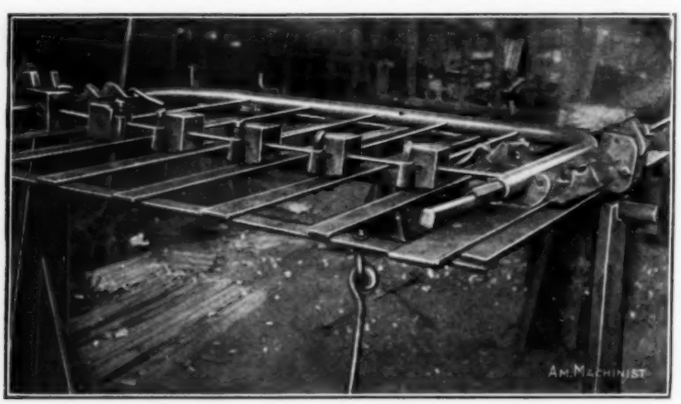


FIG. 2. FIXTURE IN HORIZONTAL POSITION FOR ASSEMBLING FRAME AND RODS

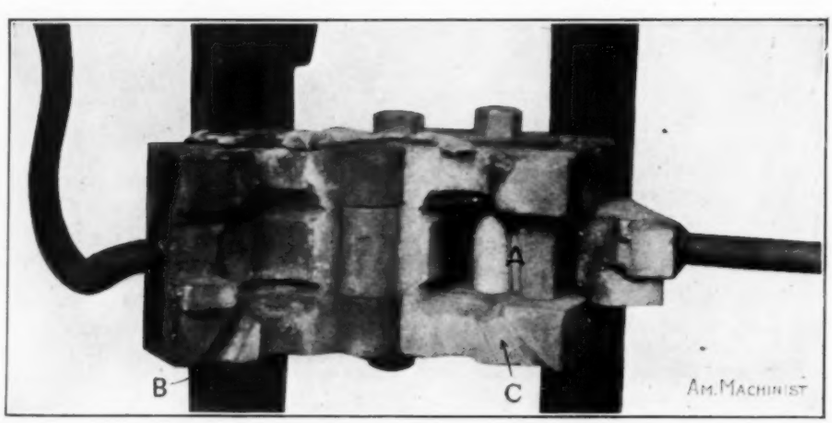


FIG. 4. ANOTHER TYPE OF RAIL-BRACKET DIE

FIG. 3. RAIL BRACKET AND THE CHILL USED IN MAKING IT

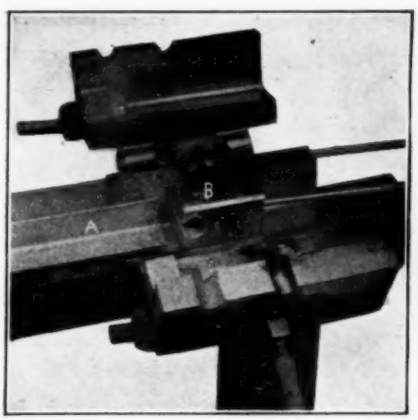


FIG. 7. RAIL-END CHILL WITH RAIL IN POSITION

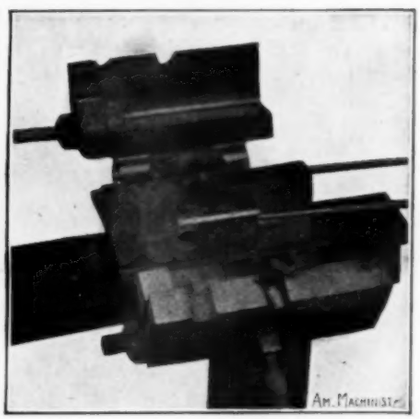


FIG. 8. THE SAME CHILL WITH RAIL REMOVED

is opened the block remains in the slot of the bracket, and is removed by striking it with a hammer. One of these blocks is shown at *H*, and also in another type of chill at *A*, in Fig. 4.

The chill shown here is for one of the ordinary type rail brackets, requiring a ferrule of iron to be cast around the post, and is especially adapted to small posts. The chill illustrated is upside down, the gate being shown at *B* and *C*. The parts of the chill are closed and locked by pulling the handle *D* around, and hooking the lever *E* down on it.

A very close fit for the parts of the mold is not necessary, as the cast iron chills easily, and unless the gap or hole is quite large will not run out to any extent. A small amount of overflow iron is shown lying on the chill, which is considerably more than generally escapes.

A fixture with a number of open chills in place is shown in Fig. 5, and those on the right are shown enlarged in Fig. 6. In this halftone *A* is a chill for one of the cross-rod brackets, *B* is part of the gate, and *C* and *D* are places for the rods to lie in. There is another rod-groove behind the clamp *E* opposite the groove *D*. The movable half *F*, is hinged to the other part at a 45-deg. angle in order to allow for the three rood-grooves and the gate, which are at right angles to the sides.

The chill *G* is for the lower bracket on the post, the gate being shown at *H* and the small rod-groove at *I*, the post of course lying in *J*. The chill *K* is for the rail bracket and needs no further explanation.

CASTING ENDS ON RAILS

The side rails of iron bedsteads are made of pieces of angle iron with iron ends cast on them. This is done in a fixture set on a stand long enough to hold the entire rail, so that both ends may be poured at the same setting.

In the foundry these rail-end casting-fixtures are placed in a row parallel with each other, so that two men with ladles can go down the line and pour the opposite ends of a dozen or so.

One of the chills is shown in Fig. 7

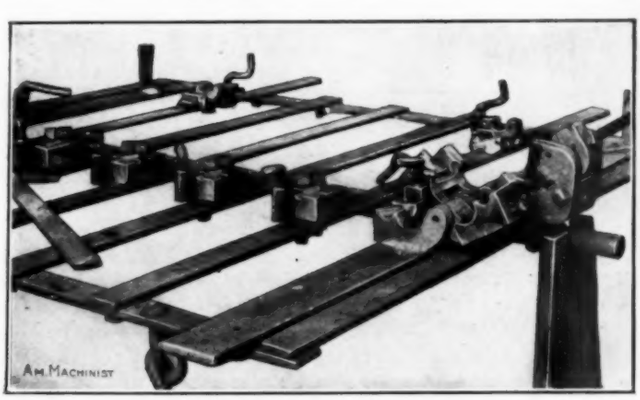


FIG. 5. A FIXTURE WITH CHILLS OPEN

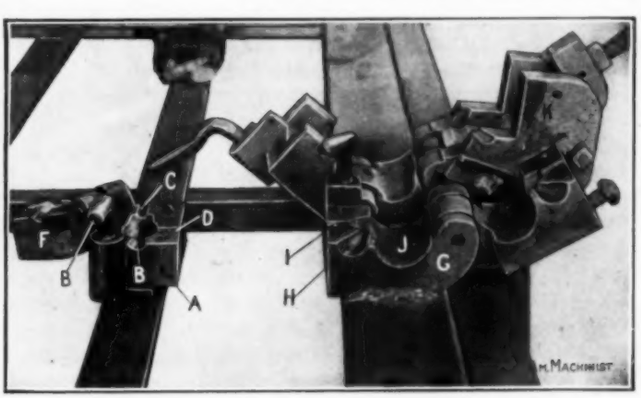


FIG. 6. ENLARGED VIEW OF SOME OF THE CHILLS

with the end of the rail in position at *A*. The form for the outer end and tongue of the casting is shown at *B*. This form is made separate, so as to be easily knocked off the casting, as the tongue tapers to match the slot in the bracket on the post. The gate is shown at *C*, and the method of locking the parts together is the same as in the previous example.

The same chill with the rail removed, is shown in Fig. 8 and one can get a clear idea of the form of the casting from the looks of the mold. No fastening device is needed on the rail to hold the cast ends, as they hug the angle iron tight enough for all purposes.

In making the chills for this work they are cast from patterns to as near the desired form as possible and very little machine or hand work is done on them, as a rule, though the chills for the rail ends and rail brackets are a little better made than the others.

Thanks are especially due to Superintendent Upton for assistance in obtaining the photographs from which the accompanying illustrations were made.

Blanking and Drawing Dies for a Double-Action Press

By H. B. Church

These dies were constructed to operate on light soft brass, the size being 0.8125x0.012 in. The press was a short-stroke, double-action press, the drawing stroke being 1½ in., while the blanking stroke was ¾ in.

driven betwen the press head and the punch holder.

The blanking punch is made in two parts in order to facilitate machine work in the construction of the tools. The line *A* shows a front view of the method of fitting these two parts together, while the line *A* and *A*¹ shows the side view of the same piece. This piece is held in place by the dowel pins *B* and *B*¹ and the screws *C* and *C*¹. The blanking punch itself is held in place in the punch holder by means of a setscrew *S*.

The drawing punch is also made in two parts in order to simplify machine work. The flat piece *L*, which actually does the work of drawing the blank, is fastened to the drawing punch holder *I* by the screw *M*.

The drawing die *F* is carried by the die holder *G*, which is machined to dovetail into the die bed *K*. The blanking die *E* is also dovetailed in the bed *K*, the stripper being held in place by the four screws *N*.

In operation the dies work as follows: The stock is carried in a coil on the front of the press and drawn over the dies by a set of feed rolls fastened by screws on the back of the press and operated by a ratchet, which in turn is operated from the crankshaft of the pres by means of an eccentric and a rod.

The flat blank is punched from the stock by the punch *H* operating through the die *E*. This punch is so situated that when the crankshaft of the press which operates the ram carrying the punch *H* is at the extreme position in its downward stroke, the blank is pushed through

where the inaccuracy or variation in slitting the stock will not affect the application of the product to the use for which it is intended.

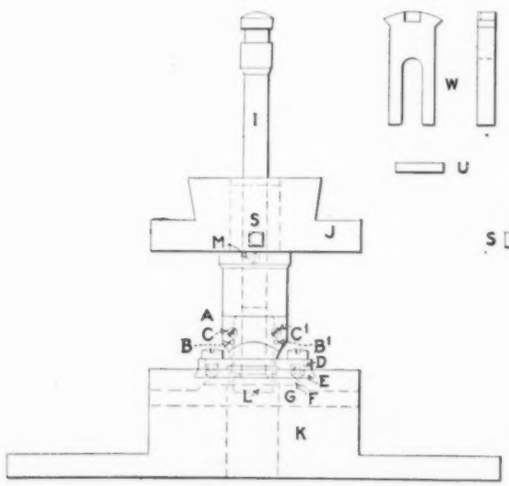
In this die the stock is fed in from the front, but the feed rolls are carried on the front of the press and the stock is fed with each stroke of the press to a stop. The blanking punch has only one cutting edge *X*, which operates as a shear and cuts across the metal, leaving no scrap. The blank drops into the set edge, which is adjustable (as are also the blanking shear and drawing dies) and is pushed through the drawing die in the same manner as in the dies shown in Fig. 1.

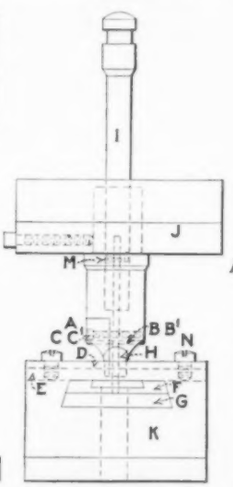
In Fig. 2, *A* is the blanking and *B* the drawing die. The blanking and drawing punches *D* and *E*, respectively, are similar in construction to those shown in Fig. 1. The feed rolls are seen at *F*.

In operating, the process is as follows: The feed rolls carry the stock a fixed distance with each stroke of the press, the punch *D* shears the stock and carries it to the face of the drawing die, where the drawing punch encounters it and forces it through the die *B*.

The advantage in the use of a set of tools constructed along these lines is that by charging the drawing punch, the die being adjustable, a range of several sizes of the product may be made with the same tools.

According to *Nature* the use of metallic tantalum has been proposed for standard weights. Owing to the high price of platinum, a suitable substitute





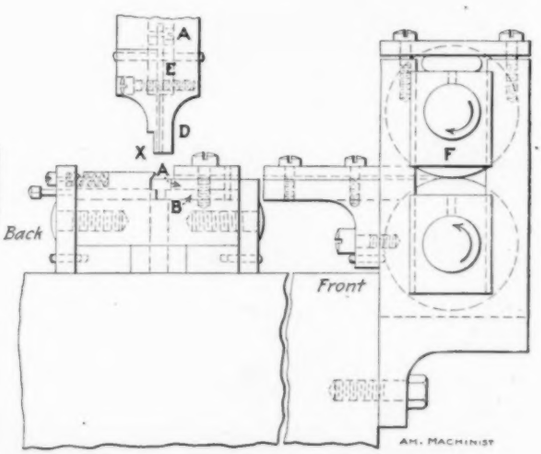


Fig. 1 Combination Blanking and Drawing Dies for a Double-action Press Fig. 2

In Fig. 1, *J* is the punch holder in which is fastened the blanking punch; this holder is dovetailed into the head of the press. The drawing punch *I* is keyed to the drawing plunger of the press by the slotted key shown at *W*. The punch holder *J* is dovetailed to correspond to the blanking ram of the press and is held in place by means of a key

the die *E* to the face of the drawing die *F* in such a position as to be correctly located when the drawing punch *I*, coming downward to the drawing die and encountering the blank, pushes it through the die *F*, forming the blank shown at *Y*.

Another method of constructing a die to do work such as this is shown in Fig. 2. This type of die is practical only

had long been looked for. Tantalum is not attacked by acids (hydrofluoric acid excepted) and is not affected by atmospheric influences. It was suggested to make a series of 100 gram weights of this metal, for use in chemical research. The cost, it is claimed, would not be more than one-third of the iridium-platinum weights now in use.

Erecting Panama Canal Lock Gates

By Fred H. Colvin

There are 46 gates in this stupendous undertaking, with an approximate total weight of 60,000 tons. Each gate consists of two leaves, the erection of which calls for unusual accuracy in work of this size. Obtaining watertight joints in heavy castings, in the setting of which an allowance of only $\frac{1}{4}$in. is made in a total height of 77 ft., affords an illustration of this precision.

All who recall the article published in Vol. 35, page 49, will be interested to know how the gates are being erected in position in the locks of the Panama Canal, so as to be ready for use as soon as the canal itself is completed. These gates, it will be remembered, consist of two leaves, each 67 ft. long and averaging 77 ft. high, with a thickness of 7 ft., and an average weight of 660 tons for each leaf. A fair idea of their size can be obtained from the reproduced photographs, which show the erection of the gates in the two upper locks.

A lower portion of these gates is made watertight, the same as the hull of a steel vessel, so that the gates will float in the water of the canal and not only reduce the power required to swing them, but also greatly relieve the thrust and side pressure on the bearings. There are 46 gates in all, making 92 leaves, or a total of approximately 60,000 tons, which would make several good size ships.

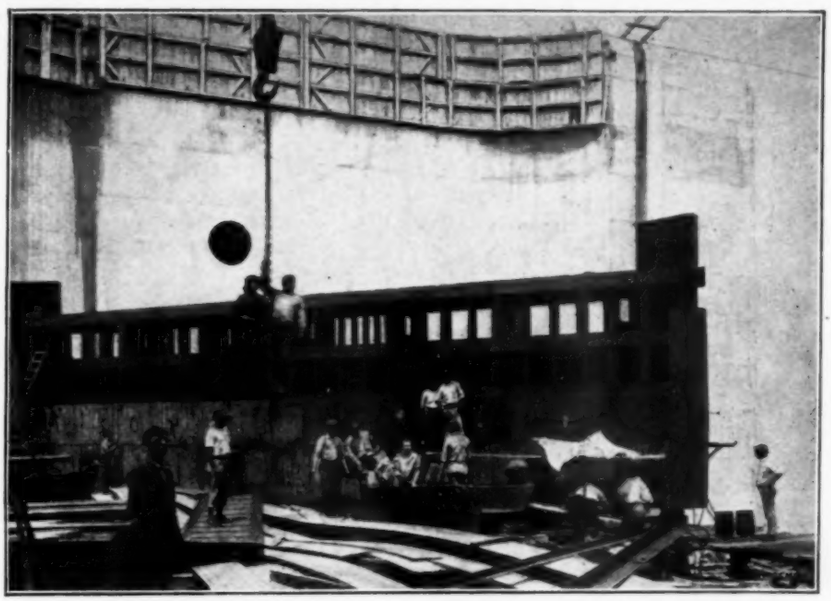


FIG. 1. GATUN UPPER LOCKS. CONSTRUCTION OF UPPER GUARD GATES

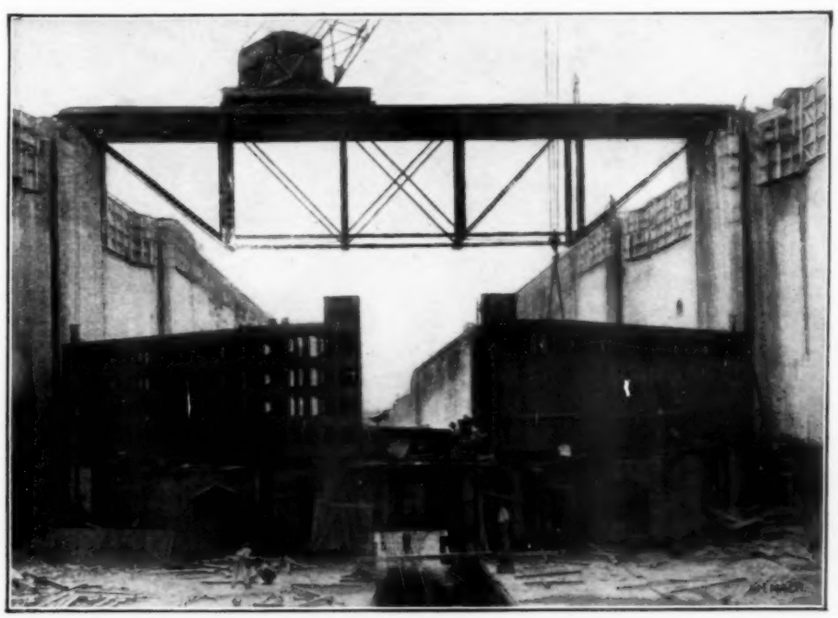


FIG. 2. GATUN UPPER LOCKS. VIEW LOOKING NORTH

ERECTING THE GATES

A view of one leaf being erected in the upper lock at Gatun is given in Fig. 1. This shows four courses of the structural work, two of these being covered by the plating. It also gives a general idea of the construction of the leaves as well as the position in the concrete wall of the locks themselves.

A view from the other side, Fig. 2, includes the two leaves which form the entire gate, and also shows the overhead bridge erected for carrying a traveling crane to facilitate the handling of structural material and the plates. It also makes a very convenient passageway across the locks. The crane chain supporting the men in Fig. 1, can be seen in Fig. 2 lowering a plate into position on the other side of the right-hand leaf.

The leaves are being erected as near a closed position as practicable, and rest on specially devised wedges and rollers so that, after being completed and with the sills in place, the completed gates can be rolled into position and lowered onto their bearing. Ample provision has been made for all the work of moving and lowering the leaves into place, which, considering their weight and size, is no easy task.

The opening under these gates which contains the railroad tracks, has been left for convenience in transporting the material from one lock level to the other, and will be filled as soon as the work has been sufficiently advanced. Some idea of the dimensions can be had by comparing the gates with the men who are at work around them.

HOW THEY LOOK IN PLACE

A good view of a gate being erected in the upper locks at Gatun is presented in Fig. 3, which shows the bridge already referred to, through the opening between the ends of the two leaves. Six courses of the plating have been riveted in place, and as will be seen, welts are riveted over the seams where they are fastened to the horizontal bracing. It will also be noticed that a steel framework has been built on each side of the gates for handling the plates and providing platforms for the workers. This, together with the traveling crane shown in Fig. 2, is used for holding the plates while they are being fastened into place.

Another view, Fig. 4, gives a good idea of the size of the work, comparing it

with the locomotive on its way through the opening in the wall.

The openings in the side contain large hooks to which hawsers can be fastened in case it becomes necessary to moor a vessel while it is in the locks. Fig. 4, also shows the erecting structure on the other side of the gates.

It may be interesting to note that the distance between the lock walls at the point where the gates are in position is 110 ft., and that the lift, or raise of the wall through which the locomotive is passing is over 30 ft. The actual lift for vessels at this lock is 28.3 ft., the extra depth at this point is to allow a place for dirt to collect so that it can easily be removed whenever it becomes necessary.

The Watertight Joints

The joint between the center ends of the leaves is made by curved pieces of nickel steel, which will be forced together by the closing of the gates. The joint between the inner or hinged ends of the leaves, and the side wall of the canal, is even more difficult and requires some exceptionally good work in setting the molds for concrete work.

Nickel-steel bearing surfaces, termed reaction plates, are also used at this end, and must make a watertight joint between the gates and the walls. In order to insure a tight joint at this place, heavy castings are set in the wall, and the concrete poured around them, these castings holding the nickel-steel plates, which make contact with the gates themselves.

Close Work in Setting Castings on Concrete

It is absolutely necessary that these joints be as watertight as possible to avoid waste of water in locking vessels through. It will readily be seen that it is no easy matter to set the castings in the concrete so as to be not only in the correct position to line up with each other, but also perpendicular, so as to hold the nickel-steel plates in a position to make a watertight joint.

The allowance in setting these castings is only ¼ in. in the total height of 77 ft., which requires extremely accurate work and great care on the part of the foreman of the concrete gang. It is interesting to note that only one set of plates has failed to come within the desired limit. In this case, the upper plate was out of line. This was caused by damage resulting from contact with a concrete bucket, which fact was not reported to the foreman before the concrete was poured. The plate had to be chipped out and reset.

The nickel-steel plates themselves are bolted to the castings set in the concrete, against a lining of babbitt metal, which is used to allow for unavoidable variations. After these castings are all in place, the nickel-steel reaction plates are set up and carefully lined so that their curved faces are vertical. Babbitt is then poured between these and the castings, a maximum allowance of ½ in. in thickness being allowed. The final line-up of the curved faces of the plates must be within a $\frac{1}{32}$-in. limit of perpendicular, which is remarkably accurate work on anything of this size, and set in concrete.

One of the reaction plates set in position, as well as the end of a gate which was being erected at the Pedro Miguel locks, is shown in Fig. 5. These are the nickel-steel strips, some of which had to be planed at the Gorgona shops, in order to secure sufficient accuracy to pass inspection.

Some of those who read the original article on the construction of these gates have wondered as to the way in which the hinge for the upper end of the gate was held in the concrete wall. Investigation showed that the hinge itself is of particularly heavy steel casting and that it is anchored in the concrete wall by heavy bars and links, which run back into the concrete, at an angle, for about 30 ft., thus making the hinge practically a part of the wall itself.

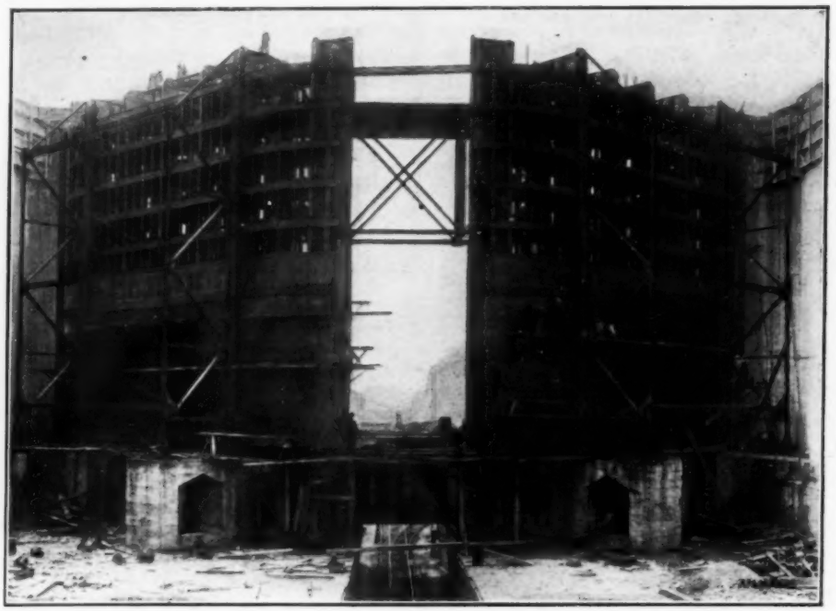


Fig. 3. Gatun Upper Locks. View Looking North, Showing Progress of Construction of Upper Guard Gates in the East Chamber

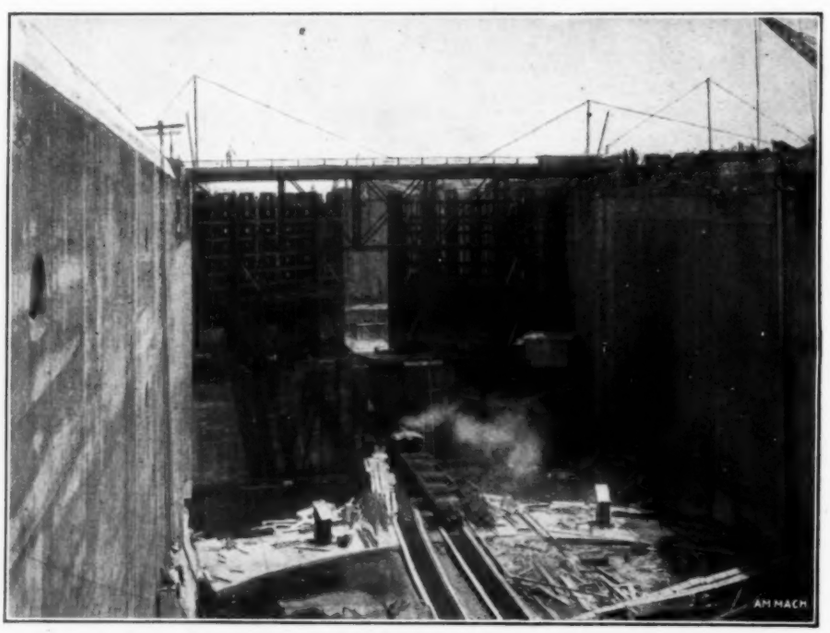


Fig. 4. Gatun Upper Locks. View Looking South, Showing Progress of Construction at Upper Guard Gates

Setting Huge Gate-valve Castings

Another interesting job of setting castings so as to be correctly imbedded in the concrete, is shown in Fig. 6. This shows one of the frames or casings for what is known as the Stoney gate valve, which will control the flow of water through the culverts in the side walls and into the locks.

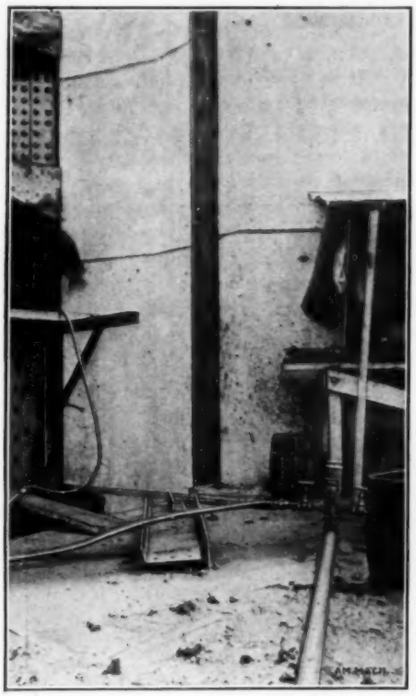


Fig. 5. Reaction Strip in Place

It will be remembered that these culverts are 18 ft. in diameter, which is the usual size of tunnels for railroad trains. The water is controlled by two gates, as can be seen in Fig. 6. These gates have rollers on the edges, so as to make them easier to handle. The frames shown are being set so that the concrete can be poured around them, holding them in the correct location and also maintaining them in a vertical position. The gates shown are in the Miraflores upper lock, indicating that the work is progressing with almost equal rapidity the whole length of the canal.

In connection with the pouring of concrete, it may be interesting to note the way in which the concrete is being mixed at both Miraflores and Pedro Miguel, as can be seen in Fig. 7. This is a large portable concrete-mixing plant, which also forms the base for the cantilever crane on top.

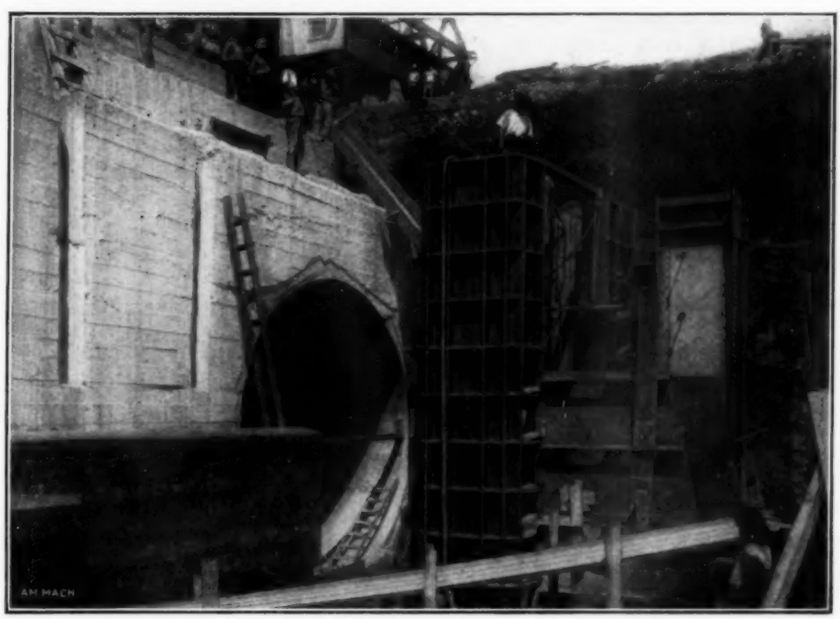


Fig. 6. Stoney Gate-valve Frame in Position at Miraflores Upper Locks

This crane handles both the cement, sand and stone from the right, and the mixed concrete from the left, when necessary. In the case shown, the concrete is being poured into buckets on the flat cars and carried to other points; but in some cases the same overhead crane handles both.

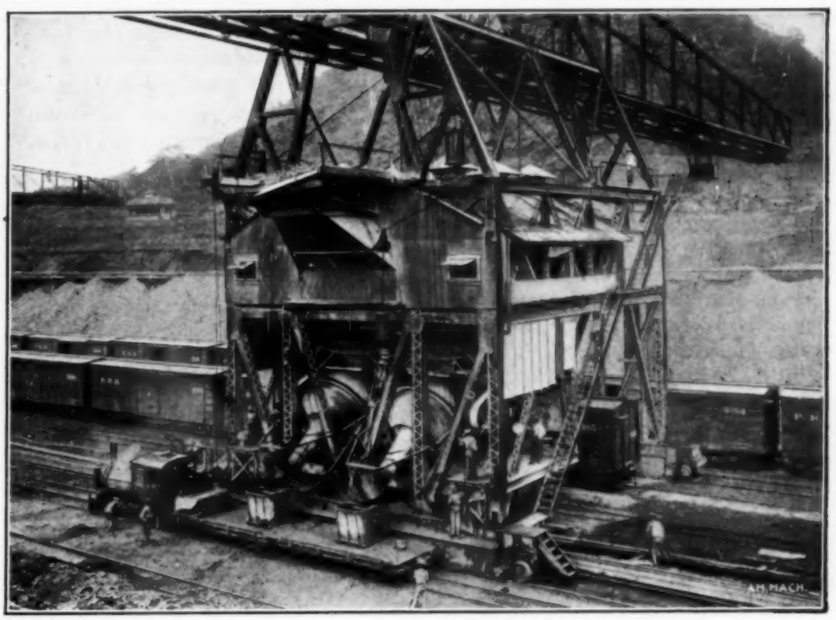


Fig. 7. Portable Concrete-mixing Plant

This whole mixing plant can also be moved to any desired position, as each leg of the gantry truck is mounted on substantial tracks, the whole thing being moved through block and tackle, by motors. There are several varieties of these overhead cranes, all seeming to answer the requirements of the particular places where they are used.

[A later issue will illustrate and describe the gearing for operating the emergency gates, together with tests of the efficiency of this gearing, which was designed especially for this work.—Editor.]

The total trade with the Philippine Islands for the 8 months ending with February, 1912, amounted to over 30 million dollars, against less than 14 million in the corresponding months of 1909, the last year prior to the enactment of the law admitting domestic merchandise from the United States into the Philippines free of duty, and domestic products except rice, of the Philippines into the United States free of duty. The value of iron and steel manufactures sent to the Philippines in the 8 months ending with February, 1912, is 3½ million dollars, against 1½ million in the corresponding months of 1909; of machinery alone the total for the 8 months ending with February, 1912, being considerably more than 1 million dollars, against less than ½ million in the corresponding months of 1909.

A New Oil-Testing Machine

By C. H. Benjamin*

It has been designed to overcome three difficulties often met with in such machines: A tendency to heat outside of the test journal; the difficulty of removing the test journal, and the difficulty of calibrating the pressure mechanism.

*Dean, Schools of Engineering, Purdue University.

This machine possesses some novel features. It was designed after some experience with other forms of apparatus for testing lubricants. Three difficulties have been met in testing oils and other lubricants: The tendency of the machine to heat outside of the journal being tested; difficulty of removing the test journal for repairs or renewal, and the difficulty in calibrating the pressure mechanism. These disadvantages have been largely overcome in the present machine.

Referring to Fig. 1, it may be seen that the test journal consists of a sleeve *S* mounted on a shaft whose journals *J* rotate on four large cast-iron supporting wheels *W*. These wheels are carried on two steel shafts, which turn in bronze half-boxes protected by dust caps. There is thus no rubbing friction on the main journals and the velocity of the wheels is so small that little heating occurs at the supporting shafts.

The main shaft is turned by a driving shaft, and the pulley *D* connected through a flexible coupling *K*. If necessary, this coupling can be insulated. The test journal is a steel sleeve *S* keyed to the main shaft and easily removable. It can be varied as to size and material if desired.

The sleeve, the journals, and the supporting wheels are accurately ground. The test-bearing *B* can also be readily removed or changed; by varying its length, the intensity of pressure can be changed at will. This bearing is carried in a cast-steel yoke *Y* and the pressure is applied through a link and turnbuckle *T*. A system of levers terminating in the scale beam *L* allows the load on the bearing to be varied from zero up to several thousand pounds.

A counterpoise *P* balances the weighing mechanism. The friction of the bearing is measured by a scale beam *H*, attached to the friction lever *F*. The latter is fastened to the yoke *Y* and is so adjusted as to be level when a static load is applied to the yoke. The scale beam allows the friction load to be weighed by tenths of a pound up to 50 pounds.

A cap *C* restrains the endwise movement of the journal, but is kept loose so as not to cause friction and heating. In many cases, it can be dispensed with entirely. The test bearing is provided with a thermometer well and with a sight-feed oil cup for the lubricant. The finished machine is shown in Fig. 2.

Calibrating and Experimenting

In calibrating the machine, the various weighing levers are balanced as on any testing machine. The lever *Y* is adjusted in the following manner: The coupling *K* is disconnected and the supporting shaft journals are well lubricated, leaving the test journal free to turn. A load is applied by the weighing lever *L* and the position of the lever *F* is noted. If it is not level, the machine should be leveled by *F* laterally and finally by *H* longitudinally. The lever *L* can be adjusted to the zero by means of the turnbuckle *T*.

In conducting an experiment, the load should be applied gradually, the oil supply being regulated meantime. When the conditions are favorable, the regular test can be started, observations being made on the speed, the feed of oil, the friction

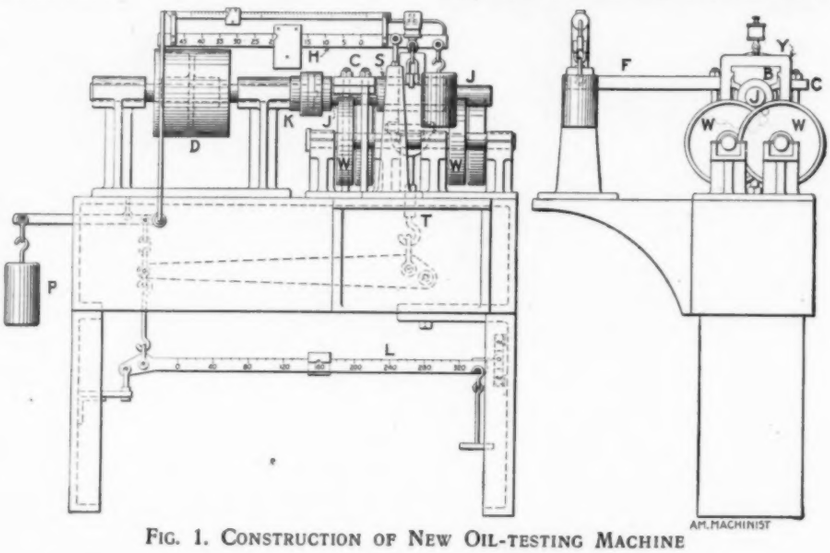


Fig. 1. Construction of New Oil-testing Machine

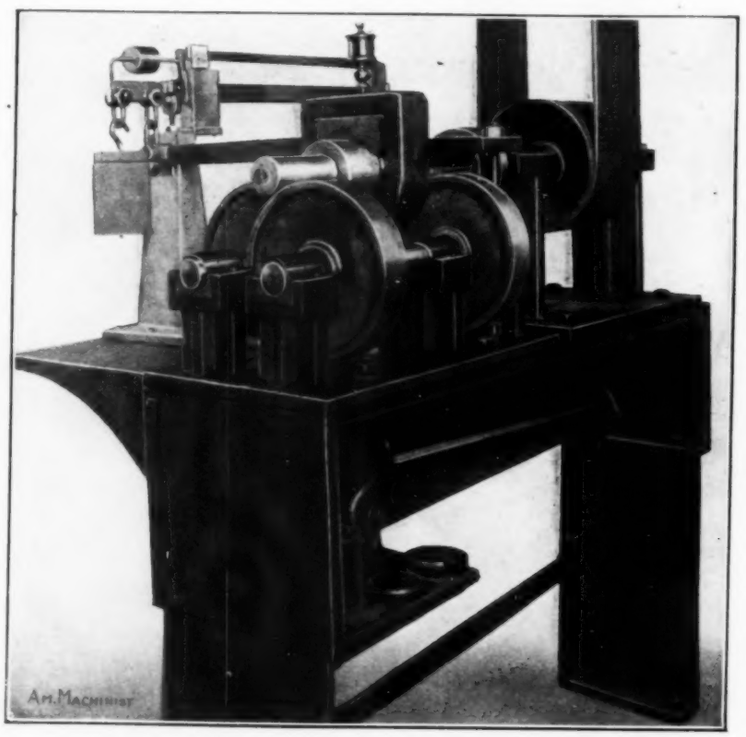


Fig. 2. Front View of Oil-testing Machine

and the temperature of the room and bearing.

The scale beam *H* is kept level by shifting the upper poise; the scale beam *L* is leveled by adjusting the turnbuckle *T*, the weight remaining constant during the run. There will be a slight vibration of both levers, but if the journals are true, this will not be excessive.

Behavior of an Oil under Test

The usual behavior of an oil under test is as follows: At first the temperature will be low and the friction high; as the experiment progresses, the bearing will warm up, at first rapidly and then more and more slowly, until the temperature becomes stationary. The friction will diminish in a similar manner and finally become constant. The bearing is now in running equilibrium for this particular oil, load and speed, and will so continue indefinitely. This temperature of equilibrium increases with the load, with the speed and with the thickness or viscosity of the lubricant.

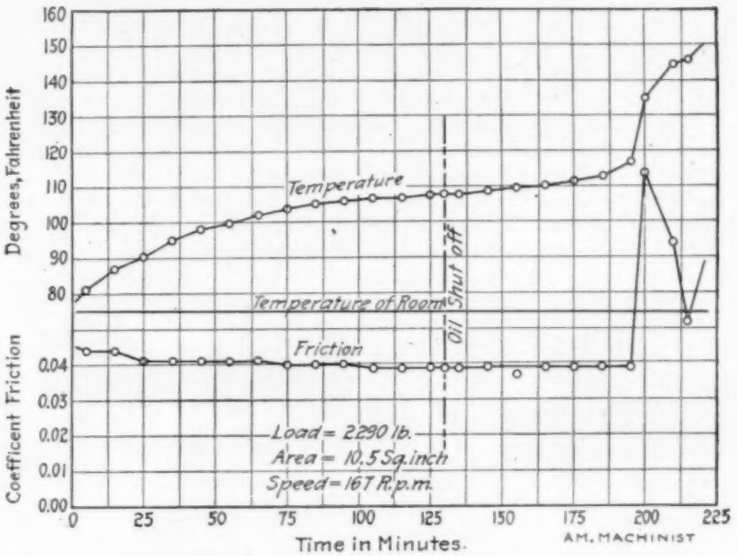


Fig. 3. Characteristic Temperature and Friction Curves for a Good Oil

If the supply of oil be cut off, the other conditions will remain about the same for a longer or shorter time, depending upon the endurance of the oil. Sooner or later, a rapid rise in temperature, accompanied by sudden variations in the friction, shows a disintegration of the oil film and the experiment comes to an end. Fig. 3 shows characteristic temperature and friction curves for a good oil.

The oil in question has a rather high coëfficient of friction, but possesses considerable endurance and is a *safe* lubricant. The curves are drawn from data of an actual test on the machine just described. It will be noticed that the curve of temperatures reverses near the point where the oil is shut off, and this gives a danger signal before the film breaks. The value of an oil as a lubricant is measured by a low friction, a moderate temperature and a long endurance.

Cutting "Pi" Leads on Worms

By Glenn Muffly

When it is desired to cut a worm to run with a diametral pitch wormwheel, the lead of the worm is a certain part of "Pi" (3.141593 in.) instead of a certain part of one inch. Of course, there is another problem to be considered in the difference between the normal and the axial pitch of the worm, but the point here considered is how to get the correct number of threads in each 3.141593 in. on a regular lathe, not having a "Pi" lead-screw.

The same problem comes up in cutting a screw with such a lead or in making the hob to cut the wormwheel. The first requirement is to find a gear ratio as nearly as possible equal to the quantity 3.141593. It has been found that $\frac{355}{113}$ equals this quantity to the last decimal point above given.

Now supposing that we have a lathe geared to cut a certain number of threads per inch and it is required to cut that number of threads in "Pi" inches, ordinarily considered as 3.1416. While the spindle makes the same number of revolutions as before it is necessary to move the carriage 3.1416 times as fast, or in other words to gear up the lead-screw in the ratio of 355 to 113.

Taking an ordinary engine lathe with a five-pitch lead-screw, we would cut five threads per inch with gears of equal size on the spindle and on the screw. Suppose that it is required to cut a worm of eight diametral pitch, that is with an axial pitch of ⅛ of 3.1416 in. or 0.3927 in. The first thing to do is to determine what gears will be required to cut a thread of eight per inch and then gear up with the ratio above given.

A Typical Example

To cut eight threads per inch the ratio is 5 to 8 or as given on the index plate of the lathe in question, a 40-tooth gear on the spindle driving a 64-tooth gear on the lead-screw. Putting this in the form of a fraction and multiplying by the Pi ratio we have:

$$\frac{40}{64} \times \frac{355}{113} = \frac{driving\ gears}{driven\ gears}$$

Factoring and canceling we have:

$$\frac{5 \times 5 \times 71}{8 \times 113}$$

which may be resolved into:

$$\frac{25 \times 71}{8 \times 113}$$

and introducing the factor 3 above and below the line we can arrange a train of gears as follows:

$$\frac{75 \times 71}{24 \times 113}$$

This means a 75-tooth gear on the spindle driving an intermediate 24-tooth gear on the same stud with a 71-tooth gear, which in turn drives the 113-tooth gear on the lead-screw.

The ratio 355 to 113 is a good one to remember as it might come in handy in gearing up for other purposes. Another way of stating it would be to say that the circumferences of a circle is $3^{16}/_{113}$ times the diameter. This is much more accurate than the common rule of using $3^{1}/_{7}$ and is even more nearly correct than the decimal constant 3.1416.

In a paper before the Pittsburg Foundrymen's Association, the importance of bringing constantly to the minds of foremen the necessity for caution and care in the habits of the workmen is pointed out. The burden of stimulating the foremen and heads of the departments rests almost entirely upon the management of the plant. The managers' and foremen's attitude toward the prevention of accidents will be reflected by the workmen just as accurately as their attitude toward the production of castings is reflected. If the manager treats the subject lightly, his assistants will look upon it in the same way. If he shows a determined desire to avoid accidents, and have the rules of the plant obeyed, if he makes prevention of accidents one of the most important features of his department, then the foremen will reflect his attitude toward the work, and will see that the men take the precautions which are known to be necessary for the prevention of accidents. While hard to understand the attitude toward accident prevention is largely a matter of habit; just as much so as the habit of cleanliness in the shop.

Some Automobile Shop Fixtures

By G. W. Linn

The machining of parts for the front and rear systems of automobiles is a problem that has evolved special tools of a design both efficient and unusual. A few of these are presented in this article.

A jig for drilling the steering-pivot holes in the ends of the front axles is shown in Fig. 1. These holes are line reamed after drilling. Fig. 2 shows a drill jig for the spring-clamp bolt holes in the front axles and is provided with a right- and left-hand screw. This is turned by a handwheel on the end, and operates two slides to which the steering-pivot bearings are pinned. This takes care of the varying lengths of the axles and always insures placing of the springs equidistant from each end and the same distance apart on each axle.

Two clever fixtures for drilling brake spiders and counterboring a concave surface for the seat of the spherical end of the truss rod washer are shown in Fig. 3. Note the two angle adjustments in the base of the jig to the left for drilling and counterboring the truss-rod holes, these being on different angles.

Before being cut in halves, the brake expanding ring, together with the brake lining, in its proper position, are placed in the revolving drill jig, Fig. 4, and drilled for rivet holes.

The base of this jig is clamped to the drill-press table with the drill in line with the first row of holes, and the second row is drilled by pulling the revolving part out toward the front until against the stop washer *X*. This causes the drill to be in line with the second row of holes.

A fixture for milling clutch teeth in wheel hubs, also the gages used for measuring both the clutches and clutch teeth in the hubs, is shown in Fig. 5.

After the rear system has been assembled, it is tested for noise on the test block shown in Fig. 6. An electric motor *A* is connected by a universal shaft with the driving pinion in the gear case of the system; this pinion, which is of the herringbone type, meshes with a larger gear mounted upon a differential case and connected with the large cast-iron drum *B* by the shaft *C* which is squared on one end and has a clutch on the other which meshes in the drum hub. Friction is applied to the drum by a brake regulated by the handwheel *D*.

A rheostat *E* and a controller *F* govern the flow of the current. The volt and ammeter *H* registers 60 volts and the brake is applied to the drum until the ammeter registers 37 amperes. Running this way for a couple of hours any unusual noise, such as rattle or noisy gears, is detected and eliminated.

A fixture for accurately grinding parallel the faces of universal driving shafts is shown in Fig. 7. The shafts are held against the hardened and ground stops by centers mounted in pivoted blocks which in turn are actuated by the spring *A*.

Motor-support frames are drilled in a jig shown in Fig. 8, the work being located by a right- and left-hand screw. A milling fixture, Fig. 9, for milling brake-connection shackles and brake-rod yoke ends has proved a great time saver. With this fixture four, instead of one, are milled, and there is the added advantage of being able to load the opposite side while milling.

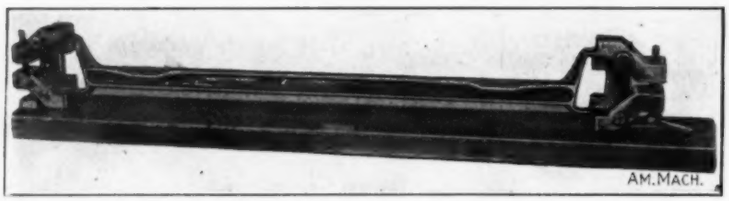


FIG. 1. JIG FOR DRILLING PIVOT HOLES

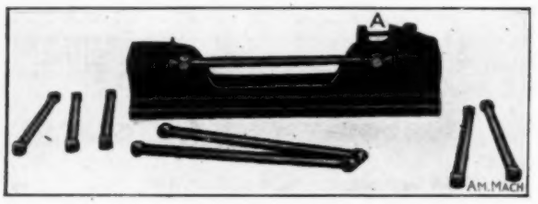


FIG. 7. FIXTURE FOR GRINDING DRIVING SHAFTS

FIG. 3. DRILL AND COUNTERBORING FIXTURES

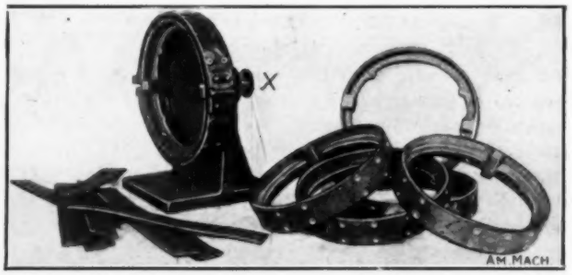


FIG. 4. REVOLVING DRILL JIG

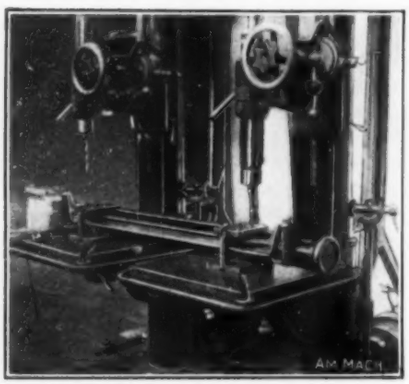


FIG. 2. DRILL JIG FOR BOLT HOLES

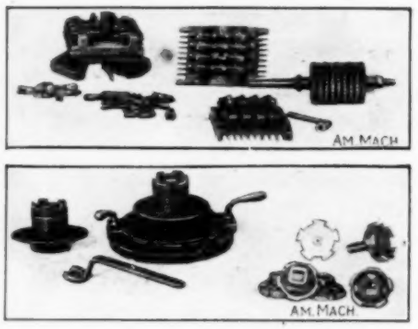


FIG. 5. FIXTURE FOR CLUTCH TEETH

FIG. 9. A QUADRUPLE MILLING FIXTURE

Grinding Wheel Efficiency

By Revere Chapell

The erroneous impression is held by many, that if a grinding wheel lasts a long time, it is a good one. They are not likely to consider the amount of work done by such a wheel.

Wheels vary in size of grain and in the strength of the bonding material, called grade. It is obvious that there must be a combination of grain and grade which is most suitable for the work at hand. Any other combination would be unsuitable, and under such conditions, the wheel-cost would be greater or the production less than if the proper combination were used.

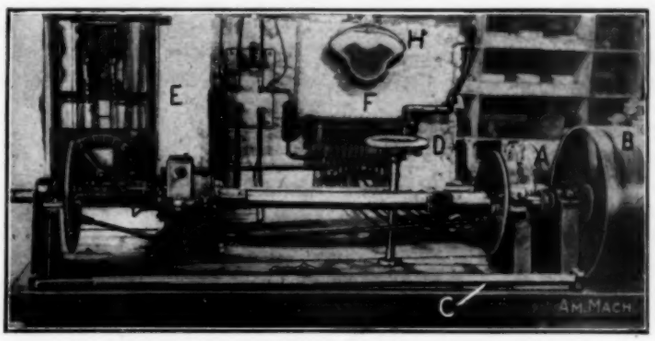


Fig. 6. Noise-testing Block

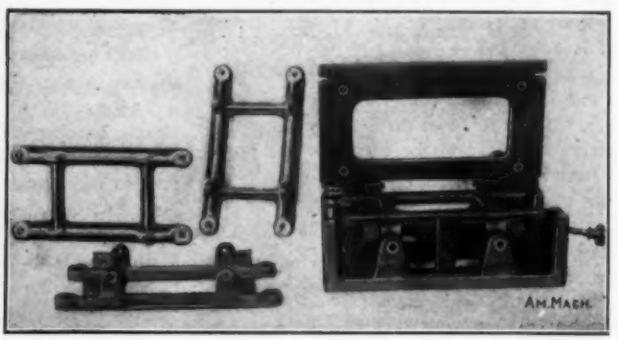


Fig. 8. Jig for Drilling Motor-support Frame

A wheel depends for its cutting upon the sharpness and temper of its individual grains and the ability of these grains to resist dulling. If the grains do not fracture or loosen themselves from the surface of the wheel when they have become so dull that they no longer cut freely, the wheel is not efficient, being too hard, or in other words, bonded too strongly. If, on the other hand, the grains loosen themselves, or fracture too readily, before they have performed the proper amount of work, the wheel is too soft, or weak in strength of bonding material.

Various Conditions Affecting Wheels

There are various conditions affecting the efficiency of a wheel on a given piece of work. Chief among these are the amount of material to be removed, the finish required, the breadth of contact of the wheel against work, the condition of the machine, the speed of the wheel, and also the ability of the operator. Take, for instance, a filing operation. If much material is to be removed, naturally a coarse file is used. Just as naturally a coarse wheel in grinding off a large amount of material should be used. Also if a finer finish is required, a finer file is necessary, and for the same reason a finer wheel should be used to produce a finer finish in grinding.

It would be possible to do the rough operation with the fine wheel, but at a greatly reduced rate of production, which would make the wheel expensive. On the other hand the rough wheel could be made to produce a very fair finish, but only at a loss of time made necessary by the delicate truing, which is nothing more or less than dulling the grain points to prevent deep scratching.

On the fine work the rough wheel would be expensive, owing to the time required to keep it in the condition necessary to give the desired finish. On the rough work the fine wheel would prove costly, because it could not remove the material rapidly, on account of the small clearance between the grains. Loading, glazing or rapid wear would be the result. Neither wheel could earn the amount it ordinarily would if used on the proper class of work.

It appears reasonable to conclude that the amount of material to be removed, or the finish required, governs the size of grain, and that the proper degree of hardness will give greater production for a given amount of time and expense.

The contact of the piece being ground, against the wheel, affects the life of the wheel. By contact is meant the area of material actually in contact with the wheel. For example, narrow contact could be likened to the fins of a casting, and broad contact to the large gates. The fins are thin, and do not have much dulling effect on the grains, but they do have the very important one of acting as a dresser of the wheel. The wheel in this case should be quite hard and coarse; hard, to prevent too rapid wear and to offset the dressing effect, and coarse, to allow sufficient clearance between the grains, permitting the material to be removed rapidly.

The gates do not have the dressing effect owing to the much broader contact, but they do require more work from the wheel, because of the greater amount of stock to be removed. As the wheel does more work on the gates, the grains naturally become duller, and should be permitted to break loose while sufficiently dull. On this, one could use a softer wheel, as in this case the wheel is not subjected to the hacking effect of the fins.

Changing these wheels about, and not using them for their proper class of work, would prove expensive. The "fin" wheel would wear well on the gate work, but owing to its hardness, would require such constant dressing to prevent glazing, that this, together with the resulting waste, would make the wheel both costly and inefficient. On the other hand, the "gate" wheel if used on fin work would prove a brilliant cutting wheel while it lasted, but not being hard enough to withstand the hacking of the narrow fins its cost would be prohibitive. Thus, to secure greatest efficiency, we must consider contact. The broader the contact, the softer the wheel used, and *vice versa*.

Effect of the Machine on Wheels

The construction of the grinder has considerable influence on the efficiency of the wheel. On one machine, a wheel may seem perfect, but when changed to another machine, it may prove a failure. The reason for this is in the difference in rigidity of the machines, the bearings, speed, and possibly the operator. Of course, a grinder, even though it may be for rough work, should be kept in good condition, not only for efficiency, but for safety. A light, shaky machine requires harder wheels than heavy rigid machines.

Speed is a very important detail when considering efficiency, and the wheel makers' recommendation (usually five to six thousand surface feet), should be remembered and adhered to as far as possible. A wheel will wear out more quickly on a poor machine than on a good one, the work in each case being the same. There is no economy in purchasing a cheap machine for grinding purposes. A poor machine will eat up the difference in cost in a very short time, by the waste of wheels, and loss of production.

Some Difficulties to Overcome

In purchasing the wheels, the more you tell the manufacturer of the conditions under which you expect to use them, the more readily he can determine the proper grade of wheel for your particular work. Some difficulties to be overcome in the use of wheels, and which lessen their efficiency to a certain extent, are burning

of the work, glazing or loading of the wheel, soft spots and wheels out of balance. A wheel burns when it is too hard. The cutting points become dull, but do not break out. Thus more heat is generated by friction than can be carried off by the mass of the material, or the cooling agent, if any is used. Greater efficiency can be secured by using a softer wheel, provided, of course, the wheel speed, and the size of grain, are right.

Glazing is the dulling of the surface points in the wheel, and is the direct 'cause of burning if sufficient pressure is used. Glazed wheels should be considered in the same manner as those that burn. Loading is the filling of the pores of the wheel with the material that is being ground. This is a very common occurrence in soft metal grinding and can usually be overcome by using a finer, softer wheel.

Soft spots are, except in rare cases, simply due to the imagination, and can practically always be made to disappear by increasing the speed of the wheel. Wheels are sometimes out of balance after being used for a time. This is due to their having been put in perfect balance when new, by the manufacturer, but not having been rebalanced by the user as the wheel gradually wears. However, very few wheels require balancing at all, and this is becoming less and less a detriment to the efficiency of the grinding wheel.

Complaints are sometimes made by users, that wheels are softer as they wear nearer the center. A wheel will certainly act that way if the surface speed is not constantly maintained. Also the contact between the wheel and the work becomes sharper as the diameter of the wheel is reduced. It must be remembered that there are not so many cutting points in a wornout wheel as there were when it was first put to use, and naturally if the same amount of work is required of it, each grain must consequently do more work, causing the grains to become dull more rapidly, and to break out sooner. This is what makes the wheel appear softer toward the center, even though the surface speed may be maintained.

It follows thus, that after wheels are worn down to a certain extent, it is not economical to use them for their original purposes. It is then obvious that the wheel that will perform the greatest amount of work in a certain time for a given cost, is the wheel most profitable to use.

Europe is the great market for the copper manufactures exported from the United States. Of the 621 million pounds of copper pigs, ingots, etc., exported during the nine months ending with March, 608 million pounds went to Europe, as against but 12 million pounds to Canada and about one million pounds to all other countries.

A Broaching Fixture

By F. A. Brown

This is a fixture designed to remove the irregularities from the front edge of a typewriter margin stop scale, so that the paper finger brackets will slide freely upon it.

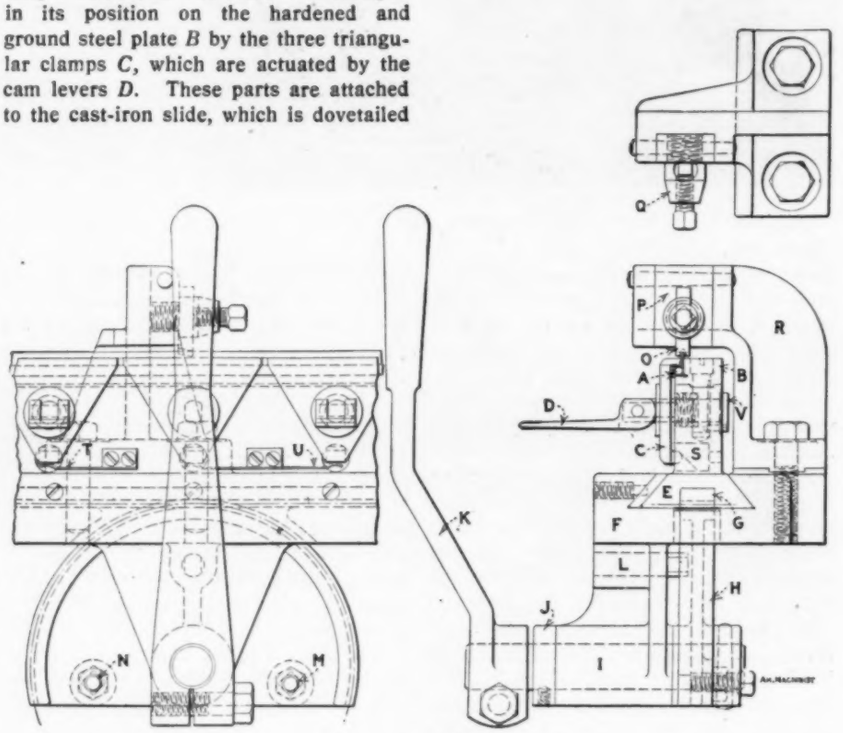
The scale is about 10 in. long and is bent up from brass tubing and then the figures and graduations are stamped on. This latter operation causes the irregularities mentioned and makes it necessary to take a very light cut along this edge.

The operation of this fixture is very simple and rapid. The scale *A* is clamped in its position on the hardened and ground steel plate *B* by the three triangular clamps *C*, which are actuated by the cam levers *D*. These parts are attached to the cast-iron slide, which is dovetailed into the cast-iron base *F*. The slide is moved back and forth by the rack *G*, which is screwed in the slot in the bottom and meshes with the gear segment *H*. The segment is pinned to the inner end of the shaft *I*, which passes through a bearing formed by a lug that is part of the base *F*. The shaft is located and held in position by the collar and pointed setscrew *J*. The operating handle *K* is a steel forging and is fastened to the shaft with a split bearing and clamp-screw.

The pitch radius of the segment is such that a half revolution gives the required movement to the slide. The pin *L* and the two square-head setscrews *M* and *N* are the stops for the movement of the segment in either direction. By backing up one of these stop screws enough to pass the pin *L*, the segment can be thrown out of mesh with the rack, thus permitting the slide to be taken out very conveniently when desired.

The stationary cutter *O* is formed so as to produce a round edge on the work and is backed off in such a way that it may be ground on the front side without changing its shape. It is held in position against the clapper *P* by the tool post and setscrew *Q*. These parts are made of machine steel and pack-hardened. The cast-iron bracket *R* is tonged and bolted to the base and forms a rigid support for the cutter.

Particular attention is called to the clamping device. These clamps are designed to draw both in a downward and horizontal direction at the same time.



A Broaching Fixture

This is accomplished by the fulcrum point resting upon a 45-deg. surface, which is formed by the hardened-steel plug *S*. This plug is slipped into the counterbored hole in the casting *E*, thus making a very cheap construction. Furthermore, it does not weaken the casting and takes up no extra space.

When the clamps are released, the cam levers *D* are in a perpendicular position and being flattened as shown, the coil springs back of the clamps push them out about $\frac{1}{8}$ in., and the flat springs *T* and *U* lift them up about $\frac{1}{32}$ in. This puts the clamps in a convenient position for putting in and taking out the work, and also gives plenty of space for removing the chips from the locating surfaces with a small brush.

The cam-lever stud *V* is flattened off on the sides where it passes through the clamps and the hole in the clamp is shaped to suit, thus preventing it from swinging around when released.

Practical Methods of Hardening Hobs

Several of the better answers received from practical hardeners in a steel hob hardening contest.

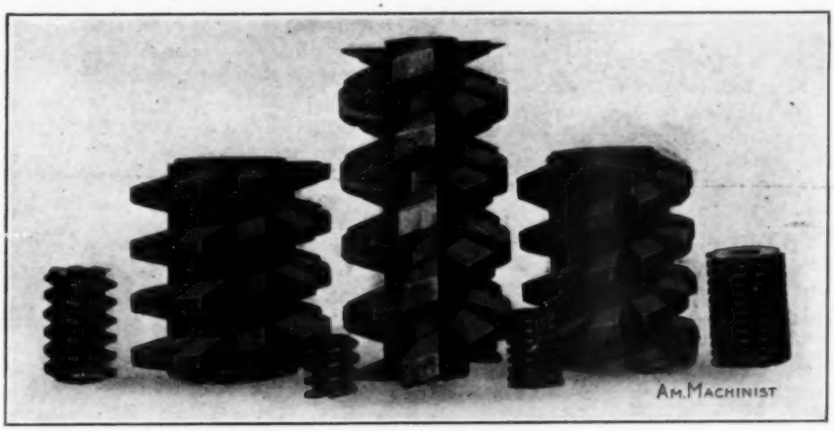
The answers give methods of holding the hobs, furnace temperatures, and quenching fluids found to give satisfactory results.

Some time ago the Colonial Steel Co. offered a cash prize for the best description of the safest and best method of hardening and drawing three unusually large worm-gear hobs, made by the R. D. Nuttall Co., Pittsburg, Penn., of colonial special annealed tool steel, having a 110-point carbon. These hobs were 4-in. pitch, double thread, 9½ in. outside diameter by 18 in. long; 2½ pitch single thread, 11⅛ in. outside diameter by 11⅜ in. long; and 3-in. pitch, double thread, 9¾ in. outside diameter by 11⅜ in. long, respectively.

The prize was awarded to George T. Coles, tool-hardening foreman of the H. Mueller Manufacturing Co., Decatur, Ill., who offered the following suggestion:

The Method Approved

Get two pairs of strong tongs to fit the hobs on the opposite sides of the hole. Have the tongs grip the holes without touching, except at the points of the jaws. These should be stub-pointed and the points turned in. The legs of the tongs should be bent about 45 deg., bringing them out of line with the hole in the hob.



Hobs To Be Hardened

Bring the furnace to 1000 deg. F., put the hob in and heat slowly and evenly up to 1300 deg. F. Take out and hang up to cool by a hook, inserted through the hole. Heat the furnace again to 1000 deg. F., put in the hob and heat to 1400 deg. F. The heat must be even and uniform or the teeth will crack.

A pyrometer should be attached to the furnace and the instrument checked with a good horseshoe magnet. This should hang on a brass rod, by a pivot in the center of the magnet and the hob tested for magnetism every few minutes. When the hob ceases to attract the magnet, close the door of the furnace to allow the hob to even up in temperature and overcome the effect of the open door.

Have the helper take one pair of tongs, first showing him exactly what to do, and take the other pair yourself. When ready, grip the hob firmly and both together quench as quickly and as perpendicularly as possible, moving up and down in the bath. This should be of brine strong enough to float a potato and from 68 to 70 deg. F. The bath should be large enough to thoroughly cool the piece before becoming unduly heated. Keep the hob in the brine until the singing noise has almost stopped. Take out and plunge in lard oil until cold enough to handle. Test with a good file for hardness.

The hob should then be boiled in a strong solution of soda water for 15 min. In the meantime, bring the oil-tempering furnace to 212 deg. F. Take the hob from the kettle and put it in the tempering furnace, which should be heated up slowly to 400 deg. F. Take the hob out and plunge in lard oil again until cold. If proper care is taken to get an even heat at that temperature, the hob will come out hard, sound and will give excellent service.

Other Interesting Answers

The following excellent answers were received from other practical hardeners, whose names accompany the methods they recommended:

The first thing necessary after the hobs have been completed and backed off and ready for tempering, is to ascertain if there are any deep scratches or extra sharp corners thereon; correcting this, see that the furnace is thoroughly cleaned and that no oxidized chips are left in the furnace, then bring the furnace up to 1200 or 1400 deg. F. After this has been obtained, place the hobs in the furnace, letting the barrels of the hobs rest on two small blocks of iron or firebrick, in order to let the heat thoroughly circulate through and around the hobs and give them an even heat.

After this has been brought up to about 1400 deg. F. or to a cherry red, have a barrel or tank of perfectly clean water of a temperature of about 100 deg. F., remove the hobs from the furnace or forge after obtaining the desired heat, quench in this tank and thoroughly churn the hobs up and down in order to have the water circulating about the hobs. Do not remove them from the tank until they are completely cold; then remove and place them in the furnace, bringing it up to about 450 deg. F., or straw color; this, of course, depends on what class of work the hobs are for. After they have been brought up to this heat, quench them in a good clean bath of linseed or fish oil.

E. J. Mc Kiernan.

Topeka, Kansas.

Provide a good roomy muffle with top and front doors. Also make and place close to it a water drum about 24 in. long, 16 in. inside diameter and 2 in. thick. Perforate the lining with ¼-in. holes, ¾-in. centers, in zigzag fashion. Attach four 2-in. water pipes to the drum, two near the top and two near the bottom, on opposite sides. Attach to the water supply under a good pressure and provide for overflow.

Extend a track over the top openings of the muffle and drum so that the pieces to be hardened can be quickly moved. Use a double pulley and a piece of wire cable with a hook attached for handling the pieces. Fasten a clamp on the cable to hold the piece in the center of the drum when let down for cooling and put stops on the track to keep the pulley from moving too far.

Make a bolt with an eye on one end and two washers with one side of each turned ⅛ in. smaller than the diameter of the hole through the hob. Put three pins in the bottom washer. These washers and bolt make it easier to handle the hob and keep the water from inside, leaving it stronger and less likely to crack or warp.

Now assemble the bolt, washers and large hob. Set in a vertical position in the muffle and heat to a nice clear red, about 1525 deg. F. Attach the hook,

raise out of the muffle, let down to the center of the drum and turn on the water. When cool, polish and set up in a muffle as before; heat slowly until the desired color is reached, then cool as before.

R. L. HIBBARD.

Kalamazoo, Mich.

I would heat in a blacksmith's forge, coke fire, gas or oil furnace, to a red heat, being careful to avoid overheating. Submerge the hobs in a bath of water and salt (½ lb. salt to 25 gal. of water; ½ gal. water to every cubic inch of metal) leaving the hobs therein for a period of one hour or more, keeping the water in motion by stirring with a paddle. Submerge in an upright position. After hardening, regrind the hobs to remove all scale on the cutting edge only, and polish ends bright.

Draw the temper in the usual way. Heat a steel or iron shaft ¾ to ½ in. smaller in diameter than the holes in the hobs. Place this shaft in the hob until the brown color shows to within ¾ in. of the bottom of the cutting edge of the tool, then submerge the hob in the water bath to cool.

FRANK G. FRINCHS.

Hannibal, Mo.

To harden the three large hobs, I would use a muffle furnace; that is, one heated with oil and which can be regulated to any required degree. First anneal the hobs by heating slowly to a very low red heat to remove any strains that might be in the steel. They should be put in an iron box with a cover over them to exclude all air and allowed to cool slowly. To harden, I would make a rest of 1x8-in. iron.

Now get a bolt 1 in. smaller than the diameter of the hole in the hob; run the bolt through the hob, set each end of the bolt on the rest, push in the furnace and heat slowly to a low red heat. When satisfied with the heat I would draw out, catch the bolt with tongs and have help enough to raise and plunge quickly into a large barrel of water about 60 deg. I would work the hobs up and down until sure the teeth were hard, and then plunge in enough hot iron to boil the water over.

Each hob should be treated in like manner, starting the furnace at a very low heat to begin each heating. After cooling, polish. To temper, get a cast-iron ring 18 in. in diameter and 18 or 20 in. long and heat red hot. Now get a bar of iron and run through the hole in the hob. Use a crane to hold up the bar and hob and thus enable you to work it back and forth in the ring. Draw to a light straw color, setting in oil to cool.

JOHN MADIGAN.

Galesburg, Ill.

In hardening worm-gear hobs I advise the following method: Be sure that your steel is forged perfectly even and without strains; then heat in a slow charcoal furnace and take great care not to bruise the cutting edge; to prevent this, put a round bar of iron through the hole and a piece of iron under each end of the bar so that you may turn easily without bruising the cutting edge; turn steadily so as not to heat one side quicker than the other. Take all the time possible to heat and do not try to force it; get the the heat as even as you possibly can. Never get the steel any hotter than the rest of the cutter, and do not get it any hotter than a cherry red. Dip in the following solution:

Four oz. citric acid in one gal. boiling water and dissolve for two minutes. Add 4 oz. carbonate of iron, stir for one minute. Let stand until agitation stops, then add 6 oz. prussiate of potash, 2 oz. of saltpeter, then mix in 12 gal. soft water and stir in 6 lb. of rocksalt; harden as in water.

This solution will harden at a very low temperature and the reamers or cutters are not so likely to crack. The higher the heat the quicker to crack. Always hold in a vertical position. Do not let the tongs touch the cutting edges. When cooling hold perfectly still until cold. Do not let cold air strike it until perfectly cold.

When drawing hobs, draw from the inside with iron rods, whatever the hole will take. Keep two or three in the fire until the desired color is obtained. Keep turning the hob on the hot rod to get an even color all around, then cool in linseed oil. Start on the small hob first and go up.

HENRY SHAEFER.

Cedar Rapids, Iowa.

As for the manner of heating the pieces I would use a gas muffle. I am assuming that the largest hob has a hole about 2 in. in diameter. The holder for the hob, which is 18 in. long, would be made of cold-rolled steel, ⅞ in. in diameter by 24 in. long, threaded on each end for a distance of approximately 3 in. Screw a nut on one end of this arbor; then slip onto the arbor in the order named, a steel collar, an asbestos washer, the hob to be hardened, another asbestos washer, another steel collar and then draw all together with another nut.

The steel collars should be ½ in. thick and at least 3½ in. in diameter, finished on both faces. The asbestos washer should be about 3⅝ in. outside diameter. Ordinary asbestos sheet used for packing is suitable. Reasonable care should be taken to see that the axis of the arbor is placed in the center of the hole in the hob.

The nuts will serve to handle the hob by; you also have a practically watertight compartment inside the hob. By keeping out the water the center of the hob will not harden, and by remaining soft will help to prevent the hob from springing.

Place the whole in a gas muffle leaving the door open a little so that you can revolve the hob and still keep an even heat. The proper heat can be arrived at by previously testing the muffle with a piece of steel. When the right heat is reached immerse the hob in cold water, keeping it moving until cold. Do not plunge the heated hob in cold water as there is danger of uneven hardening and warping.

Remove from the water and polish in several spots with sharp emery cloth. Avoid touching with the hands or anything that would cause the polished spots to show a deceiving color. Place the hob in a gas muffle again, using a slow fire, and keep revolving until the polished spots show a light straw color. Then dip at once into oil.

C. E. CADMAN.

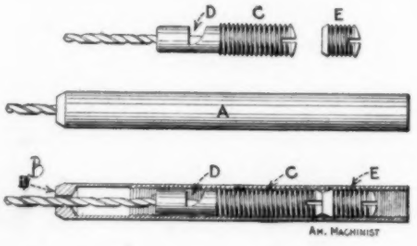
Beloit, Wis.

A Drill Chuck and Depth Gage

BY W. J. CUNNINGHAM

The illustration shows a simple method of holding small drills and gaging the depth of fluid holes.

The sleeve *A* is made of machine steel ½ in. in diameter. It is threaded internally ⅜ in. standard and drilled at the end *B* to suit the size of the drill



DRILL CHUCK AND DEPTH GAGE

being used. The face at *B* is case-hardened, as it acts as a depth gage by coming in contact with the work when the drill has reached the predetermined depth.

The holder *C* is threaded a snug fit for the thread in the sleeve *A* and is slotted at *D* to hold and drive the drill, which is flattened on one side, at the end of the shank. The holder *C* is slotted so that a screwdriver can be used to adjust it in *A*. The small blind setscrew *E* is threaded a snug fit for the thread in the sleeve *A* and acts as a check screw when *C* is set at the correct depth.

New System of Approximate Indexing

By Forrest E. Cardullo*

A proposed method which involves the use of two index plates, one movable, having 100 holes, the other fixed and having 101 holes. The regular index pin is used in conjunction with the row of holes in the movable plate, and the latter is indexed around the fixed plate by means of a second plunger.

In indexing for certain divisions the index crank and the movable plate are revolved in the same direction; in other cases they are turned in opposite directions.

Simple explanation of method of obtaining different settings.

*Professor of mechanical engineering, New Hampshire College of Agriculture and Mechanic Arts.

There are three schemes in common use by means of which a circle may be divided into a large number of equal parts, using the dividing head commonly supplied with a universal milling machine. One of these is to have several large index plates, each one drilled with a very large number of holes, so that there will be a row of holes for each of the prime numbers, besides a large number of rows for the composite numbers. This is usually known as a "high-numbering" attachment and is furnished with some of the best makes of milling machines.

Compound Indexing

A second method is known as "compound indexing." This system of indexing involves moving both the index plate and the plunger arm, and is also known as "back-pin indexing." In this system, a plunger or lock pin is placed back of the plate, so as to fit into one of the rows of holes, and the plate may then be moved backward or forward any given number of holes.

This moves the plunger arm through the same plane as the index plate. The plunger arm is then moved an additional distance, using a different row of holes, and the total angular movement of the plunger arm is the algebraic sum of the angular distances through which the plate is moved with reference to the back pin, and through which the plunger arm is moved with reference to the index plate.

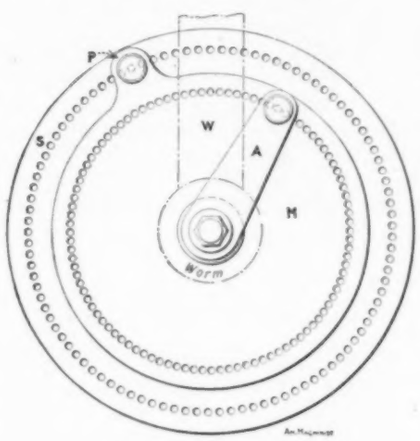
This method of indexing is tedious, the computations which must be made are complicated, and the work is consequently liable to error. If the particular combination of holes required is not available, this method cannot be employed.

Differential Indexing

The third system of indexing is known as "differential indexing." In this system the index plate is geared to the plunger arm in such a way that the plate moves through an angle proportional to the angle through which the plunger arm is moved, and the movement of the plunger arm is then the algebraic sum of the actual movement of the plate and the relation movement of the plate and the plunger arm.

By using a sufficient number of gears, a large number of divisions may be effected; and one maker furnishes an attachment which by this means will divide all numbers between 1 and 382.

A system is proposed here of approximate indexing, involving the use of a simple attachment for the universal head, which, while it will not divide all numbers accurately, may with very little trouble be arranged to divide angles so that the maximum error in a 12-in. circle, due to theoretical imperfection of the apparatus, will be less than 0.0001 in. The apparatus is as follows:



The Indexing Device

Approximate Indexing

Two index plates are used, one of them having 101 holes being fixed to the frame of the dividing head. The second index plate turns freely upon the wormshaft to which the plunger arm is fixed, and has 100 holes. This second plate has a plunger attached to it which may be inserted in any of the 101 holes in the first or fixed plate by turning it through the proper angle.

The plunger arm fixed to the worm may, in turn, be turned through any angle, and the plunger inserted in any one of the 100 holes upon the second or movable plate. If both plungers be moved, the worm will turn through an angle equal to the algebraic sum of the angles turned through by the movable plate and by the plunger arm with reference to the movable plate. The apparatus is shown in Fig. 1.

In this figure, W is the wormwheel fastened upon the spindle of the index head. The ratio of the worm and wheel is 40 to 1, so that one complete turn of the worm causes the spindle to make $^1/_{40}$ of a turn. Fastened to the worm is the plunger arm A. The plunger at the end of this arm engages in any of the 100 holes in the movable dividing plate M. This movable plate turns freely upon and is concentric with the wormshaft.

Attached to it is a second plunger P which engages in any one of the 101 holes in the stationary dividing plate S. If the plunger P, to which the movable plate is attached, be moved back one hole, the plunger arm A will be moved backward $^1/_{101}$ of a revolution. If the plunger arm A be moved forward one hole upon the movable plate, it will be advanced $^1/_{100}$ of a revolution. The net movement of the worm will be the difference, or $\frac{1}{100} - \frac{1}{101} = \frac{1}{10,100}$ of a revolution, and the movement of the spindle will be $^1/_{40}$ of this, or $\frac{1}{404,000}$ of a revolution.

In the case of a circle having a diameter of 12⅞ in., which is nearly as large as most dividing heads will swing, $\frac{1}{404,000}$ of a revolution is one-10,000th of an inch on the circumference, which is not only a much finer division than is ever required in practice, but is the maximum cumulative error necessary, involved by the uses of the apparatus. Let us designate such a movement of the worm or spindle as "one division."

The Apparatus in Operation

The following example will make clear the method of using this apparatus when a circumference is to be divided into any number of equal parts. Assume that a 12-in. gear having 71 teeth is to be cut. The total number of divisions which may be made by means of the apparatus being 404,000, we will divide this number by 71 in order to obtain the number of divisions through which the plunger arm must be moved in order to rotate the spindle $^1/_{71}$ of a revolution. Doing so, we find $\frac{404,000}{71} = 5690$ with a remainder of 10. Accordingly, if the plunger arm be turned through $\frac{5690}{10,100}$ of a revolution, or 5690 divisions, 71 times, the spindle will be turned through

one revolution lacking $\frac{10}{404,000}$ of a revolution, or 10 divisions.

In order to determine what arcs the plunger arm and the movable plate must move through, so that the worm will move through 5690 divisions, we must remember that advancing the movable plate one hole with reference to the stationary plate, moves the worm through 100 divisions; and advancing the plunger arm one hole with reference to the movable plate, moves the worm through 101 divisions. Consequently, a motion of the movable plate with reference to the fixed plate, will not affect the last two figures in the number of divisions moved through; while the number of holes which the plunger arm must be moved will be given by the last two figures in the number of divisions required.

Since we have 5690 divisions, the plunger arm must advance with reference to the movable plate, 90 holes, which will move the worm through 9090 divisions. Since this is 3400 divisions more than required, the movable plate must be moved back 3400 divisions, or 34 holes, with reference to the fixed plate.

It will be seen from this that if the movable plate be moved forward 90 holes and the plunger arm moved back 34 holes, each time that the spindle is indexed, the worm will revolve through $\frac{90}{100} - \frac{34}{101} = \frac{5690}{10,100}$ of a revolution, and the spindle will be indexed through $^1/_{40}$ of this amount, or $\frac{5690}{404,000}$ of a revolution.

Repeating the operation 71 times will turn the spindle through $\frac{71 \times 5690}{404,000} = \frac{404,990}{404,000}$ of a revolution, which is one revolution lacking the 10 divisions already noted. The error introduced in the last tooth space by the excess of ten divisions, is only 0.001 in., which is but very little greater than the cumulative error found in the wormwheel of a first-class dividing head.

If, however, this error seems serious, it will be an easy matter to reduce it to $^1/_{10}$ of this amount, a quantity which would absolutely defy detection. There are 10 divisions to be distributed equally among 71 indexing operations. To so distribute them it is necessary, one time out of every seven, to move the worm through 5691 divisions. This may be done by moving the plate through 35 holes and the plunger arm through 91 holes every seventh time that the spindle is indexed.

At 10 points in the circumference we will then have a cumulative error of 0.0001 in., which is the maximum necessary error due to the imperfection of the method, and is considerably less than the errors due to the imperfection of the apparatus employed, and which would, as a matter of fact, be completely masked by such matters as changes of temperature and strains due to the weight of the parts of the apparatus.

Another Example

Let us assume as a second example a circle divided into 383 parts. Dividing 404,000 by 383 gives 1055 for the number of divisions to be passed over by the plunger arm for each time that the circle is indexed. This will require that the plunger arm be moved forward through 55 holes, while the movable plate must be moved back through 45 holes. Indexing 383 times through 1055 divisions, will revolve the spindle through one revolution and $\frac{65}{404,000}$ of a revolution besides. In order to divide these 65 divisions among 383, it will be necessary to drop one division every sixth time. Doing so we will drop seven divisions too many.

A consideration of the work which was performed in solving the preceding example will show that the method of indexing by this apparatus is as follows:

First divide 404,000 by the number of parts into which it is desired to divide the circle. The quotient will give the number of divisions through which the worm must be revolved, while the remainder will give the number of corrections which must be made during the progress of the indexing.

The last two figures of the quotient will give the number of holes by which the plunger arm must be advanced with reference to the movable plate. If the number expressed by the last two figures of the quotient is less than the number expressed by the first two figures, subtract the former from the latter and the difference will be the number of holes by which the movable plate must be advanced, with reference to the fixed plate.

If the number expressed by the last two figures of the quotient is greater than the number expressed by the first two figures, subtract the latter from the former and the difference will be the number of holes by which the movable plate must be brought back, with reference to the fixed plate.

Distribute the number of corrections indicated by the remainder as equally as may be among the whole number of indexing operations.

Application of Preceding Rules

The following example will show the application of these rules: Assume a circle to be divided into 383 parts. Dividing 404,000 by 383 gives 1054 with a remainder of 318. Since the remainder is nearly equal to the number, it will be better to take 1055 divisions, which will give an excess of only 65 divisions, instead of a deficiency of 318. The last two figures of the quotient being 55, the plunger arm must be advanced 55 holes. Since the last two figures are greater than the first two, the movable plate must be moved back 55 — 10, or 45 holes.

There are now 65 divisions to distribute among 383 indexing operations. Dividing 383 by 65, gives the nearest integral quotient as 6. Consequently, if one division is dropped every sixth indexing operation, we will drop 64 divisions, and have an excess of one division in the last space of the circumference on the circle, i.e., the last space will be 0.0001 in. larger than the others, on a diameter of 12⅞ in. In order to drop one division, we have only to move the plunger arm 54 holes and the movable plate 44 holes, instead of the 55 and 45 holes which they are usually moved.

Other Examples

A few other examples briefly given will serve to show how the work may be done in other cases: To divide a circle into 67 parts, the quotient will be 6029 with a remainder of 57. The remainder being nearly equal to the number, take 6030, with an excess of 10. Move the plunger arm 30 holes forward and the movable plate 60 — 30 = 30 holes forward. The excess of 10 to be divided among 67 indexing operations requires that one division be dropped every seventh operation. To drop one division, move the movable arm forward 29 holes and the plate 31 holes.

To divide a circle into 301 parts: The quotient is 1342 and the remainder 58. The plunger arm is moved forward 42 holes and the movable plate backward 29 holes. Distributing 58 divisions among 301 indexing operations, requires the addition of an extra division every fifth operation. This will give 60 divisions added, so that twice (e.g., at the end of the 150th and the 300th index operation) the correction is omitted. The correction is made by moving the plunger arm forward 43 holes and the movable plate backward 30 holes.

In the manufacture of tungsten-lamp filaments, the wire of which they are made must be drawn red hot, as it does not have sufficient ductility when cold. A German inventor has devised the following apparatus for drawing the wire while hot: The wire is heated by an electric current passing through it, the resistance offered producing the heat. The wire is inclosed in a chamber and the atmosphere in it made reducing or neutral. The contacts are readily made, and by regulating the quantity of current passing, the heat may be adjusted. This process also shows the possibility of annealing wire during the actual drawing operation.—*Brass World.*

New Valve Manufacturing Methods

Editorial Correspondence

Novel tapping machine for iron body valves in which no holding device is necessary.

Making the bonnet, glands and disks from sheet metal and the dies used in the work.

There have been comparatively few radical changes in the making of steam valves for many years, so that some of the methods employed by the Max Machine Co., Clinton, Mass., in making iron-body and pressed-metal valves, are of interest.

In the valve shown in Fig. 1, the body is of cast iron, the stem is made from a plain brass rod, while the seat, the bonnet and adjusting-box nuts are all of pressed metal.

As can be seen, the bonnet, the gland and the nuts through which the stem works are held in place on the body by the large clamping nut shown outside of the bonnet.

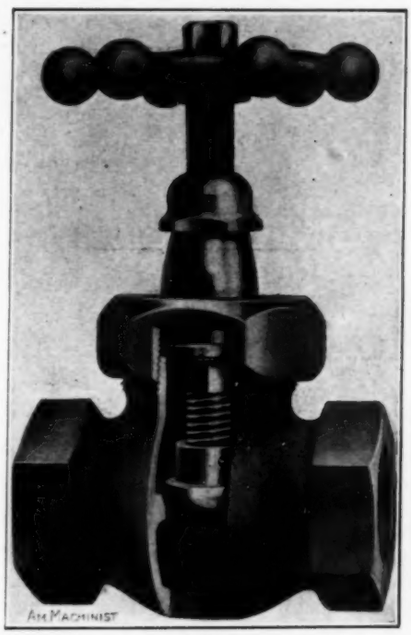


FIG. 1. IRON BODY VALVE WITH DRAWN-STEEL PARTS

Further details of the construction are shown in Fig. 2, which shows how the stem is made from a plain piece of brass rod, which avoids the necessity of turning it down from a solid rod or from a cast-ing. It also shows the bonnet and stuffing box in more detail, and it will be noticed that there is a small hole drilled near the end of the stem at the right. Fig. 3, shows the object of this and the way in which the valve seam is held on the stem.

The piece which holds the copper seat is threaded on the inside to fit the coarse thread of the stem, and on the outside with a finer thread for the nut shown at the left. A hole is drilled through one side large enough to admit the steel ball shown in the center. The seat-holder is screwed on the stem until the hole corresponds to the depression drilled in the stem when the steel ball is dropped through the hole and into the depression so that about half is in the stem and the other in the holder; then the nut is screwed over it and the seat is securely fastened on the stem with just enough play to allow full freedom in finding its seat in the valve body.

HOW THE VALVES ARE MADE

Going to the way in which the valves are made, we show in Fig. 4, first the working end of the machine for tapping and threading the valve body. This is a home-made machine with a very substantial frame, and both tap and die supported by rigid spindles. The valve body is held in the hand of the operator and the upper opening placed over the center guide *A* so as to line it up and prevent turning when the taps start into the end of the body. As soon as these are fairly started the die feed advances and begins to cut the threads on the outside for the large nut which holds the bonnet and nuts in place. Under these circumstances there is no holding device necessary and the valve bodies are completely threaded in rapid succession.

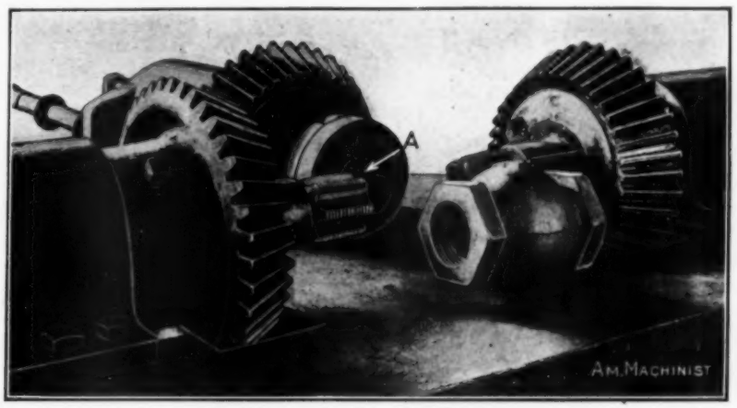


FIG. 4. VALVE-THREADING MACHINE

DRAWN WORK FOR VALVE PARTS

The other operations are interesting examples of the way in which metals can be drawn into the desired shape and require very little explanation other than appears in Fig. 5, which shows the various stages of the process.

Taking the bonnet first, we begin with the round blanks, approximately one-eighth inch thick, and a die having a plain hole with a recess in order to center

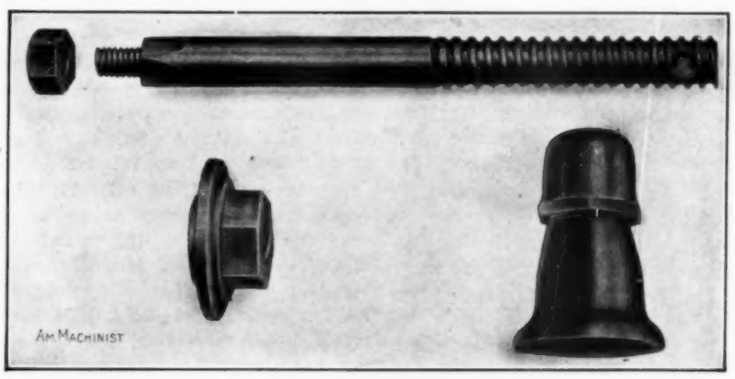


FIG. 2. DETAIL VIEW OF IMPORTANT PARTS

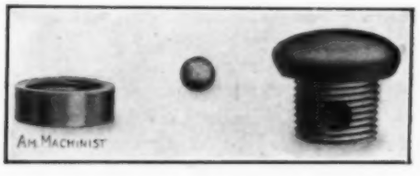


FIG. 3. HOW THE SEAT HELD

the blank and prevent die movement while the punch is getting started.

The punch is of simple, round-ended design, and of such diameter as to fill the hole with the exception of the metal occupied by the blank, so that a single passage produces the desired cup to draw into the final shape.

FIG. 5. DIES FOR DRAWING THE BONNETS

FIG. 6. THE SEAT AND THE GLAND NUT

The various stages of the drawing, as well as the dies for forming the hexagon on the lower end, are shown in Fig. 5. The punches and dies are very simply constructed and secure excellent results, for, while the corners are not drawn up to a sharp edge, there are sufficient flats to insure a good grip of the wrench in putting them in place.

The forming of the seat disk and the stuffing-box nuts is shown in Fig. 6. This disk is drawn up in the same way from a round blank and can be set into the cup shown on top of the die at the first operation. The cup is then turned upside down in the second die shown, and the hollow punch behind brought down on it to start the edge curling in so as to close around the disk-holder, which can be seen in front of the dies. The valve disk is then placed over the holder and the hollow punch brought down over the latter so as to curl the disk over the flange holding it tightly in place.

The group at the right shows the various stages in the development of stuffing-box nuts, beginning with the first drawing into the cup shape at the left. After drawing to the form with the flanges shown at the extreme right, the center hole is punched and the outside trimmed into a complete hexagon by the punch and dies shown. The piece on top of the die shows one of the nuts with the completed hexagon.

Machining Large Tubes

BY S. TROLLOPE

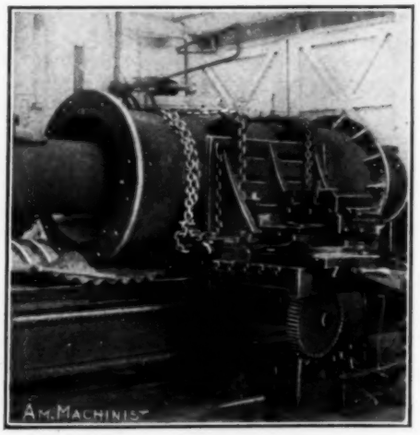
The job was to bore and face the flanges of water cylinders for pumps. They were practically pipes 24 in. inside diameter and 6 ft. long, and were cast with a riser about 12 in. long on one end. To cut off the headers, the barrels were held on the saddle, as shown, and an angle plate was bolted to the faceplate of the lathe, a slide rest carrying a parting tool being mounted on it. The feed was put on by hand.

Previously, the castings had been mounted in wooden horses, but the clearance being only 1½ in. between the cylinder and the saddle, made the horse so flimsy that it was decided to abandon this method. So the chain method was adopted.

After we cut off the headers and faced the flange on one end from the faceplate, as already described, we turned the cylinder end for end ready for boring. The lathe bed was just 6 ft. long, plus the length of the saddle, so we needed the full length of the bed for boring, and that meant mounting the tailstock separately. The ways on which the bed was movable had T-slots running their full length, so we used a 24-in. cast-iron T-piece, together with two pieces of wood packing.

The boring bar was made up of two 6-ft. lengths of 9-in. flanged pipes. Straps bolted across the two outside flanges contained centers. The tools, three in number, were clamped between the two center flanges. These flanges were about 18 in. in diameter, so the tools had a maximum overhang of 3 in. For rigidity, this boring bar would be hard to beat.

Having the bar mounted between the centers, it was an easy matter to set the job central. With two chains round the ends, and two others holding sidewise to the angle plate, there was not a suspicion of movement in the work, although there was about 18 in. overhang at either end of the saddle.



MACHINING LARGE TUBES

As stated before, three tools were used, two ground to a diamond point, and one with a flat for finishing; the tools, of course, being set one in advance of the other. Emery cloth was wrapped round each tool before being slipped in between the flanges, and setting was done with a long bar and a hammer on the back of the tools, and an old copper firebox stay and the hammer were used on the points, till the proper setting was obtained, when a final tightening was given to the bolts.

The tools were arranged so that the bolts acted as a solid stop on their backs, and were held to size within 0.0156 in. in going through the 6 ft., the job being finished in one cut.

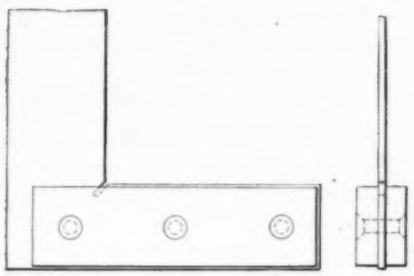
Sewing-machine exports in the current fiscal year will make their highest record and will probably aggregate $10,000,000. Over $160,000,000 worth have been exported from the United States during the 48 years since the official record of their commercial movement began, of which sum $80,000,000 worth, or half of the total, were exported in the brief period since 1900. The growth in exports of American sewing machines reflects the development of this industry, the value of its product having increased from $4,403,206 in 1860 to over $28,000,000 in 1909.

Letters from Practical Men

A letter good enough to print will be paid for.
The value is in the idea—not the length of the letter

Making a True Square

There have appeared in the columns of the AMERICAN MACHINIST, methods for making try squares of novel design all of which have been valuable. Herewith is a description of the "old reliable" which many may think too commonplace to describe. To the novice the thought of the making usually looms up large but in reality it is easy if gone about correctly. To be sure he must have at hand a good master square.



MAKING A TRUE SQUARE

First cut out a flat square of sheet steel and make as near square as you can, straight and smooth on the sides, having the short leg a little wider than the determined finished size. Next secure the pieces of tool steel for the back. Rough them out to very near the finish sizes. Carefully true up at least one side of each, clamp the trued faces together, drill and countersink, and rivet the pieces together. Now true up one end and that will be the tops of the back.

Knock out the temporary rivets (two will do) and clean off all burrs. Next clamp one of these back pieces to the blade in the correct position leaving a finish top and bottom. Drill the blade. When ready to assemble, clamp the back pieces, one on each side of the blade, and carefully ream each hole a slight taper; drive in a temporary pin and then ream the other holes the same, after which rivet up with steel rivets and be careful to fill the countersink.

When we made our blade we did not forget to cut into the corner with a fine saw. The reason for this is apparent when we get to finishing the inside of our square. Now that all are together we proceed to work down our blades on the inside to flush the back and are careful not to harm its finished surfaces. This should bring us square inside. Next finish the outside, carefully calipering the width of the blade and back. Now smooth and finish all over.

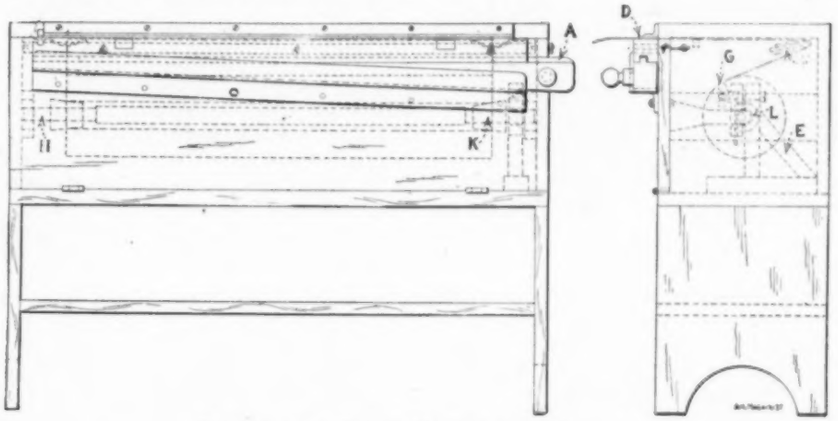
H. E. BILGER.

Philadelphia, Penn.

A Paper Holder and Cutter

The cut shows a new style paper holder and cutter which not only holds and cuts the paper but also straightens it.

To set up the machine put the shaft *H* through the roll of paper and tighten the wooden cones *K* to secure the paper. On one end of the shaft there is a tension bracket *E* the leather bearing *L* fitting the shaft. The wing-nut *G* at the bearing can be tightened for tension. The wedge-shaped piece of wood *F*, over which the paper is drawn, slips out or in and is locked after the paper has been put in place.



COMBINATION PAPER HOLDER AND CUTTER

To draw the paper from the box pull out the wedge *A*, draw the paper to the required length, then push in the wedge and tear off the paper by an upward pull, bringing the paper across the steel blade *D*.

When using the cutter it is best to draw out about four inches of paper more than is required, then push in before cutting off; this starts the next piece.

This device was designed by Thomas Fraser, of the Baldwin Locomotive Works, and is used with marked success in their drawing rooms in Philadelphia.

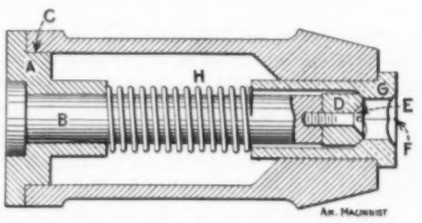
G. E. BALDWIN.

Philadelphia, Penn.

A Collet Attachment for the Monitor Lathe

Generally in the design of metal-removing tools as much attention must be paid to the chips or turnings as to the cutting tools themselves. A second lost in removing chips from a machine or tool is just as valuable as a second lost in removing the metal from the product.

In our shop we have a great many duplicate pieces which require a second chucking in order to perform a facing and countersinking operation. We experienced a loss of about five minutes every half hour, by having to stop the machine, remove the collet and clean the chips from between the collet and the hole in the spindle. These chips seemed to wedge and prevent the collet from opening up, thus causing an additional



COLLET ATTACHMENT FOR THE MONITOR LATHE

delay in removing the work from the machine.

To overcome this we designed the attachment shown. The piece operated upon is shown at *G*. The countersinking operation *F* caused the chips to run through the hole in the piece and lodge between the collet and the hole in the

spindle. A piece of tool steel *A* was turned as shown and pressed into the back of the collet at *C*. The rod *B* is a sliding fit through a hole in *A*. A piece of medium-soft rubber *D* is made a loose fit in the hole of the piece worked upon. This rubber makes a joint with the work as shown.

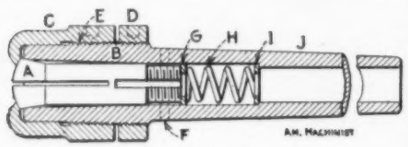
The rubber is fastened to the rod *B* with the screw *E*. A spring *H* is slipped over the rod and is compressed when the work *G* is placed in the collet. After the operations are performed and the collet released, the spring throws the work from the machine together with the chips. The rubber *D* absolutely prevents any chips from working their way back through the collet. A. R. COOPER.

Marshalltown, Iowa.

Chuck for Bench Lathe Collets in Miller

The illustration shows a chuck, designed for the use of bench-lathe collets in the dividing head of a miller.

The collet holder *B* is made of tool steel, ground at *J* to fit a standard taper



BENCH-LATHE COLLETS

hole, and has a hole its entire length. The front end is hardened and ground and fitted to receive the bench-lathe collet *A*. A thread is chased at *E* for the cap *C*, which forces the collet *A* against the taper seat and closes the chuck centrally.

The compression spring *H*, which is held in place by the washers *G* and *I* and the three screws *F*, keeps the collet *A* from sticking in the collet holder when the cap *C* is released, and also prevents chips from getting between the collet and the taper seat by constant pressure on the cap *A*. The nut *D* is for withdrawing the chuck from the dividing head.

This chuck has a great advantage over the old style draw-in spindle, for the reason that the chuck can be operated while the dividing head is in a vertical position, whereas in the old way this cannot be done without resetting the head every time it is operated, as the draw-in spindle is under it and cannot be released while in that position.

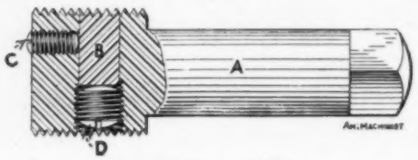
Dayton, Ohio. E. P. FICKES.

An Expansion Tap

The expansion tap shown was originally designed to retap threaded holes in which varying amounts of stock had been left before the first tap had been run through. Every machinist knows that it is practically impossible for every hole to be tapped alike, unless the same amount of stock is left for the tap each time.

The body *A* is made of machine steel, and the adjustable cutter *B* is made of Stub's steel, tempered. The hole for the cutter *B* is drilled before the body is threaded. The thread on the end of the body is slightly tapering, thus insuring the tap entering square each time.

After drilling, the cutter is inserted, backed by the headless setscrew *D* and locked in position by the screw *C*. The



AN EXPANSION TAP

adjustment to the cutter is obtained by the screw *D*. This tap will also be found useful in recutting any internal thread which has become bruised.

Dexter, Me. E. W. TATE.

Angle Irons and V-Blocks

In precision gage work the results, in a large measure, depend upon the accuracy of the tools and fixtures employed. The angle iron and V-block shown and described cannot, therefore, fail to be of interest to tool and gage makers engaged in the production of extremely accurate tools and gages.

The angle iron shown in Fig. 1 is made of hardened tool steel and is ground on

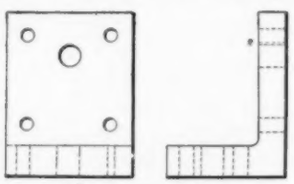


Fig. 1 Angle Iron

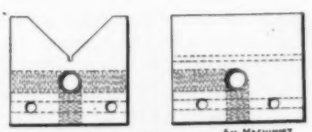


Fig. 2 V Block

ANGLE IRONS AND V-BLOCKS

the surface grinder and then lapped until all sides and edges are square with each other, using a knife-edge square to prove the truth.

The V-block, shown in Fig. 2, having an angular cut of 90 deg. included angle in its top face, this cut being equal on each side of the center, is made of hardened tool steel, and is ground on the surface grinder, after which it is lapped all over so as to bring all sides square with each other. The angle is ground using a sine-bar, the plugs of which are six inches between centers. By using extreme care in setting up for grinding, the finished block was very satisfactory.

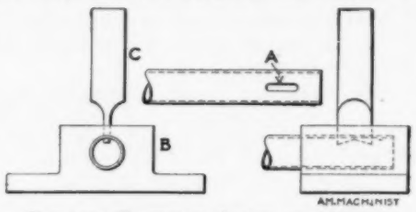
The hole tapped in the block for a $\frac{5}{16}$-18 U. S. Standard fillister-head screw permits attaching the V-block to the angle iron. It is then easy to mount the whole arrangement on the magnetic chuck of the surface grinder, when the work, previously set up and held in the V-block, can be ground to any angle desired. CHARLES F. SCRIBNER.

Hartford, Conn.

A Die for Piercing Tubings

It is sometimes necessary to pierce slots in tubing as shown at *A* in the accompanying cut.

This can be done by making a socket the tube. There is no internal die, but *B* which fits and supports the outside of



DIE FOR PIERCING SLOTS IN TUBING

the tube can be pierced without it by making the punch *C* with plenty of shear on the cutting edge.

Of course, this method would not do for heavy tubing, but I have seen it used on brass and am informed that it can be used on such work as piercing the catch slot in umbrella handles.

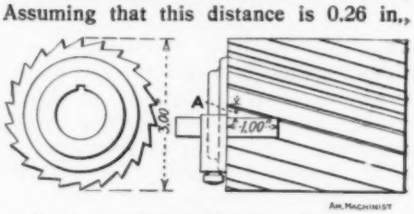
Philadelphia, Penn. W. ALTON.

Finding the Lead of Spiral Milling Cutters

Most of us have had to recut a spiral milling cutter and the difficulty in finding the lead is still with us; consequently the method illustrated should be appreciated. Although it may not be new, it certainly is not old and is well worth preserving.

For example we will take a cutter three in. in diameter, and with a small adjustable try-square measure up one in. on the face of the cutter, letting the end of the blade come in contact with the face of the tooth as shown in the cut.

With the scale ascertain the distance *A*. Assuming that this distance is 0.26 in.,



LEAD OF SPIRAL MILLING CUTTER

which is equivalent to a lead of 0.26 in. in one inch, divide the circumference ($3.1416 \times 3 = 9.4248$) by 0.26 in. and the result is 36.249 in., which equals the lead approximately.

Looking at the table of leads we find that 36.249 in. lies between 36 and

36.857 in. As 36.249 in. is nearer to 36 in. than to 36.857 in., accept 36 in. as the lead and select the gears to correspond.

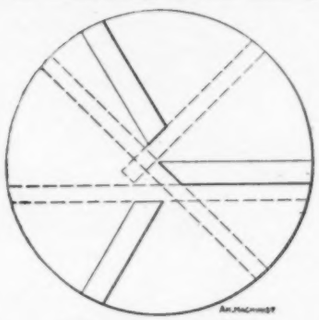
In this particular cutter the distance *A* is 0.2618 in.; dividing the circumference by *A* we obtain 36 in. It would be a very good practice if cutter makers stamped the lead on their spiral milling cutters. This would certainly facilitate recutting.

Frankfort, N. Y. G. F. OLIVER.

Spot-facing Mill

Most end mills have a small hole in the center. They are usually used on the miller and produce a smooth surface on account of the work being fed at a right angle to the cutter.

The cut shows an end mill which may be used to advantage on the drilling machine as it will not leave a burr. The construction of this tool is obvious. The flutes are milled in the usual manner and the special teeth are produced by sawing the cutter on its face as shown by the dotted lines, which are intended to represent the path of the saw.



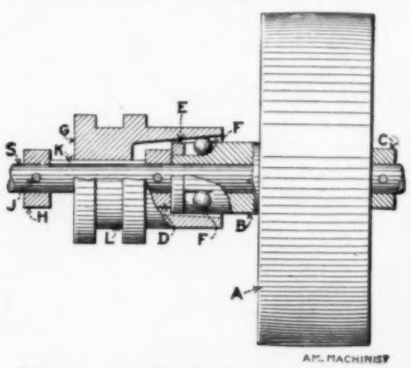
A SPOT-FACING MILL

NEVIN BACON.

New York, N. Y.

A Ball Friction Clutch

The ball-friction clutch consists of a driving shaft *S*, driving the pulley *A*, which is free on the shaft and held by the collars *C* and *D*, one at either end of of the hub of the pulley, keeping it from sliding along the shaft in either direction.



CLUTCH FOR TRANSMITTING POWER AT HIGH SPEEDS

One end of this pulley hub is larger than the other and has three or more grooves in which are the steel balls *F*, whose function is to transmit the power from the sleeve *G* to the pulley *A*. To retain the balls in proper position in the tapered groove, a collar *E* is forced on the extreme end of the hub of the wheel *A*.

To transmit power, a movable sleeve *G* is used, the inside of which is tapered about one degree. Against this tapered surface the balls are either running free or pinched according as the sleeve *G* is forced to or from the free pulley *A*. This sleeve *G* is splined to the shaft *S* and revolves continually with it, being prevented from grooving so far as to release the balls, by the collar *H*, pinned to the shaft *S* by the pin *J*. The outside of this sleeve has a groove into which the shifting rollers of the shifting lever fit.

The application of this clutch is valuable for transmitting power at high speed and where room is valuable, and its efficiency is astonishing in test.

A. C. CLAIRE.

New York, N. Y.

Bench Lathe on Auto Repairs

The valve stems in the engine of a Matheson "Silent Six" car having become badly worn, it was decided to try a few precision methods in repairing. First the cages were bored out to receive the cast-iron bushings *A* in Fig. 1. These were left slightly longer than the old bearing, thus giving better support for the valve stem. The back end of the cage was turned, and threaded for the stuffing box *B*.

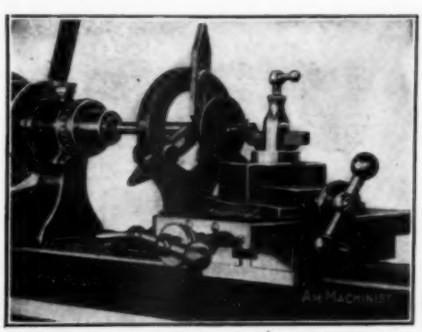


FIG. 3. BORING OUT THE CENTERS

The cage was next mounted on a true arbor, held between centers in the bench lathe, and the angle for the valve seat turned out true with the valve-stem hole as shown in Fig. 2. The valves were next taken in hand, the stems straightened up where bent or sprung, and the centers bored out true as shown in Fig. 3. The stems were then ground to fit the bushings, and the angles turned between centers in the bench lathe, using the same setting as for turning out the seats.

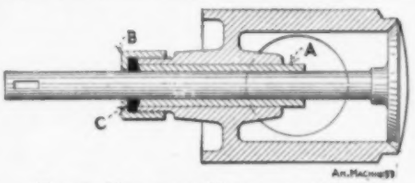


FIG. 1. REPAIRED VALVE AND GAGE

All parts being concentric and the angles of the valves and seats matching perfectly, the valves were a perfectly tight joint even before they were ground in, and when filled with gasoline showed no leakage. W. H. SAWTELL.

Waltham, Mass.

Coatings for Shop Drawings

In large plants where drawings and blueprints for the shop are subjected to a great deal of usage, it is generally advantageous to administer a preservative coating to the working faces of these drawings. The purpose of this coating is threefold. First, to prevent soiling the drawing through the absorbtion of oil and dirty water. Second, to prevent dirt obliterating the lines and dimensions. Third, to prevent scratching or tearing the drawing.

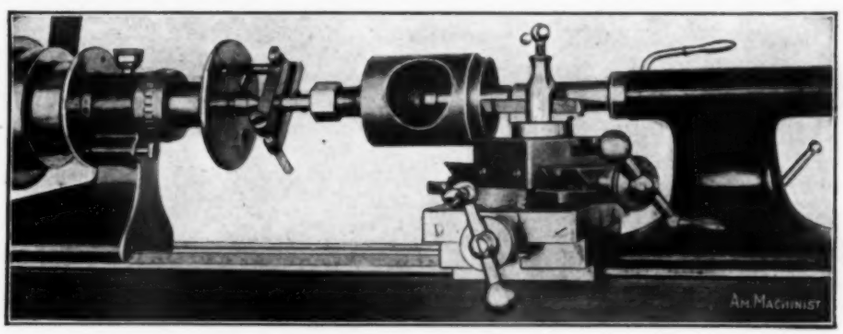


FIG. 2. TURNING OUT THE VALVE SEAT

The most common substance now used for this purpose is flake shellac dissolved in alcohol. A coating of this material painted on the face of a drawing produces a yellow transparent surface which can be removed, for changing lines and dimensions, by means of a cloth saturated with alcohol.

Another substance which gives virtually the same results, is termed gloss oil, and is a varnish-like substance produced by dissolving resin in benzine. This material is cheaper than shellac, easier to apply,

and can be removed by ordinary gasoline. Where a large number of drawings and blueprints are to be coated for shop use, it is preferable to shellac.

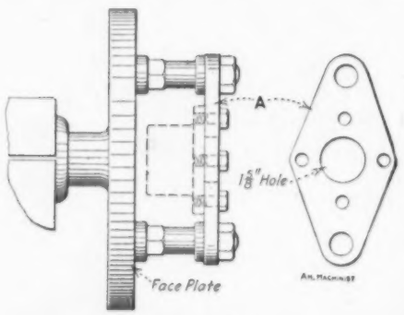
Where no changes in drawings are likely to be made, as is usually the case with shop prints, a practically indestructible coating may be obtained by painting with liquid sodium silicate. This substance soon dries, leaving a hard, clear, perfectly transparent surface.

Indianapolis, Ind. F. B. HAYS.

A Fixture for Reboring Valve Chambers

Any person having had the experience of reboring worn cylinders or valve chambers knows full well the amount of time lost in chucking and getting them to run true in relation to the face and bore, especially when the outside of the cast ing is left rough and irregular and mostly tapering.

The cut shows a fixture I made to eliminate all time lost in truing them up.



A REBORING FIXTURE

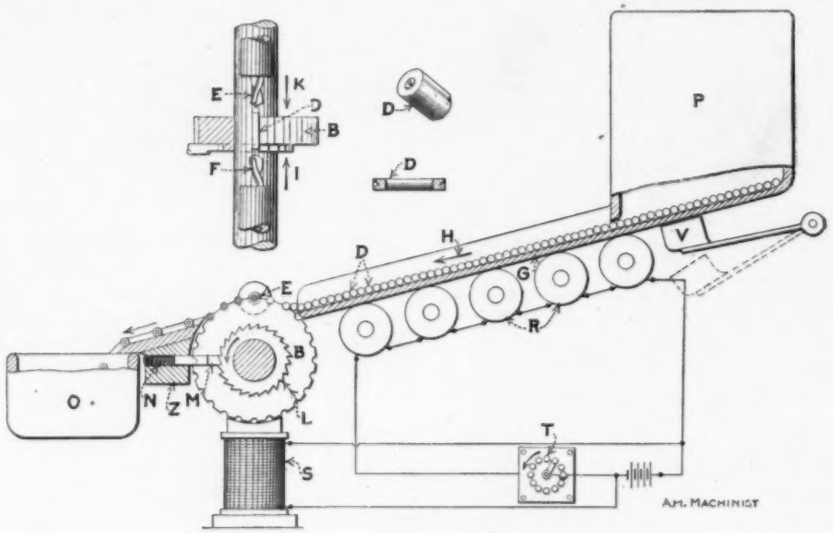
I drilled and tapped two holes in the lathe faceplate on a radial line and equidistant from the center of the plate, then screwed in two studs of sufficient length to allow clearance for entering the chamber between the plate *A* and the faceplate.

The center hole in the plate *A* was bored out to the size of the shoulder on the valve chamber after the plate was securely fastened in position on the two studs. Placing a valve chamber in the hole bored out in the center of the plate *A*, the four ⅜-in. capscrew holes were laid off from the chamber and drilled, for the purpose of bolting the valve chamber to the plate *A*. After inserting the shoulder of the valve chamber in the center of the plate *A*, and screwing in the four capscrews, it was set and ready for reboring.

Chicago, Ill. W. FISCHER HOLL.

Hollowing the Ends of Pins

The machine shown is intended for boring out the conical holes, seen at *D*, in the ends of wire pins that have been made on a wire-cutting machine. The problem was solved in the following manner: A wheel *B* was provided around its circumference with semicircular notches to receive the pins which were to be hollowed. Through suitable cams connected with the catch arrangement *LMNZ*, the pins were brought continually between the two drills *E* and *F*, which turned in opposite directions, thus rendering superfluous a special method of holding the pins between the drills. The drills *E* and *F*, also moved by suitable cams, approach at the proper moment, in the directions of the arrows *I* and *K*, and so produce the desired concavity on both ends.



AUTOMATIC MACHINE FOR HOLLOWING THE ENDS OF PINS

The pins *D*, not yet hollowed, are thrown into a hopper *P* from which they pass through an opening upon the inclined railway *G*. There, by their own weight, they slide in the direction of the arrow *H* upon the disk *B*, which receives the pins in its notches and brings them between the drills.

A vibrating arrangement *V* is provided to keep the pins from sticking. For this reason an electric interrupter *I* is provided, which sends a current only temporarily through the coils *R*, sufficing to hold the pins in position straight across the slide, but also cutting off the current intermittently so that the pins can roll down upon the disk *B*.

A magnetic coil *S* is placed under the disk *B* to assist in holding the pins *D* in the notches. The pins, after being chilled, are carried further around by the disk, stripped off and caught in a box *O*.

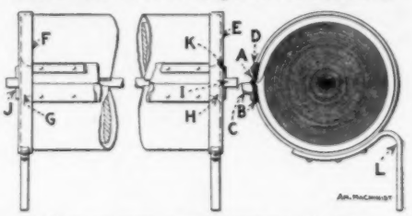
WALTER BAETZ.

Heinrichs in Thür., Germany.

Holder for Blueprint Paper

A very convenient and economical holder for blueprint paper is being used at present by one of the prominent automobile manufacturers. This holder could be used to equal advantage for drawing paper and tracing cloth.

A sheet-metal cylinder is constructed of galvanized iron about $\frac{1}{32}$ in. thick. This is made 2 in. longer and ½ in. larger in diameter than the length of the standard roll of blueprint paper. A slot $\frac{1}{16}$ in. wide and ¼ in. longer than the roll of blueprint paper is cut in the side of the cylinder, leaving an equal space at each end. Two strips of rubber, *A* and *B*, are fastened to the cylinder by means of the metal strips *C* and *D* and rivets. The two sides of the rubber strips should come together over the slot, forming a lightproof construction and also keeping the paper from backing up completely.



A LIGHT-PROOF BLUEPRINT HOLDER

The lower metal strip *C* is shaped as shown, and ground to a cutting edge on the top. This is used instead of a pair of scissors or knife in cutting the paper. Two covers *E* and *F*, in which are fastened the cast-iron bosses *G* and *H*, are fitted to the cylinder. The bosses should be just high enough to press lightly against the roll of blueprint paper, holding it in position with respect to the slot. They should also have a $\frac{13}{32}$-in. drilled hole through the center and extending through the cover.

A ½-in. steel rod *I* is used to hold the roll of paper in place, the pins *J* and *K* keeping the rod from sliding out of place. The holder may be suspended from any convenient place on the wall by means of the bracket *L* of which there are two riveted to the holder.

Elyria, Ohio. E. M. WISE.

Discussion of Previous Question

Referring to letters and articles previously published

What is a Machine Tool?

Your editorial in regard to proper definition of a machine tool opens a very interesting subject, and one that should be settled as soon as possible, as there seems to be a great difference of opinion in regard to what a machine tool is. It may be that this question will never be satisfactorily determined, but it can at least be brought down to closer limits.

The term metal-working machinery is a very broad one and can be subdivided into a great many classifications. Machine tools is one of these divisions. However, it is necessary to have specifications defining what a machine tool is; also to have these specifications as simple as possible, so that they can readily be understood by those not skilled in a knowledge of machinery, such as customs officials and legislators, who have it in their power to make and enforce laws pertaining to the import duties to be imposed upon machine tools, but who do not as a rule know what a machine tool is.

Two things are necessary before any headway whatever can be made toward satisfactorily settling the question of customs duties. First, it should be determined what a machine tool is. Until this question is settled by the builders of machine tools themselves, we cannot blame others if they get mixed up. Second, before customs duties can properly be adjusted, the whole subject should be carefully investigated by a board of experts.

However, it is not intended to discuss here the question of tariffs or the method of levying them. The question of what a machine tool is should be settled before we take up other matters pertaining to its sale and manufacture.

I believe the following definition would cover the ground: "A machine tool is a metal-working machine of that class used for cutting cast iron."

Here is a definition in such plain and concise terms that there is little chance for confusion.

Now, the question will come up at once, "Is it correct, and does it cover the ground?" Let us see. Take any machine known technically as a "machine tool" in the advertising columns of the AMERICAN MACHINIST. Here we have lathes, planers, shapers, milling machines, drilling machines, grinders, key seaters, vertical and horizontal boring machines, power hacksaws, etc. These machines all cut various other metals as well as cast iron, but the point is—they cut cast iron too, and no machine but a machine tool cuts cast iron, however much it cuts other metals.

Is it not also true that no machine that cannot cut cast iron, using a cutting tool that converts it into chips, can be classed as a "machine tool?"

Now take the advertising columns of the *Iron Age*, showing other metal-working machinery. Here we have drop hammers, punches, presses, forging machines, shears, wire-forming and straightening machines, riveters, sheet-metal machinery, etc. These are all metal-working machines, but not machine tools, as the term is understood by machine tool builders themselves; and they are not used for cutting cast iron.

Cast iron is of such a nature that in shaping it, it must either be melted and poured into a mold, or cut with some kind of a tool that converts it into chips. It cannot be worked like wrought iron, steel, brass or copper; that is, bent, punched, hammered, stretched, twisted, etc. Consequently, following our definition, a machine that is not, or cannot be used for cutting cast iron would not be a "machine tool," but must come under some other classification.

There may be some few cases where this definition cannot be considered as a positive means of identification for the reason that there are certain machines concerning which there is still a question as to whether they should be classified as "machine tools," or not.

Ordinary bolt cutters, pipe-threading machines, cutting-off machines and the like, would be in this classification, However, if it was desired to class these machines as "machine tools" the definition would apply, because they will all cut cast iron into chips, although they are used more for cutting other metals, such as steel, wrought iron, brass, etc.

The screw machine is not used extensively for cutting cast iron, but occasionally only, and is practical for such a purpose on certain classes of work. Consequently the definition of "machine tool" would properly apply to this machine, which as a matter of fact, is considered a machine tool by everybody who understands what a machine tool is.

L. H. COLBURN,
General Manager, Colburn Machine Tool Co.
Franklin, Penn.

A Cranked Screwdriver

In the cranked screwdriver described in Vol. 36, page 428, the two edges forming the so called point are in the same plane as the crank. They should be at right angles to that plane. The point is then much less likely to slip out of the screw slot when the tool is used.

OSCAR ECKENSTEIN.
London, England.

Standardization of Machine Tools

I believe with Mr. Alford in regard to the standardization of machines as far as possible, but I hardly think that he intended to convey the impression that as soon as tools were brought to a predetermined standard, no more improvements were to be considered, as one would be led to believe by Mr. Terry's article in Vol. 36, page 595.

In this article Mr. Terry states that he is in accord with Mr. Alford, and, further, that in placing an order for an engine lathe in his shop he would specify that the centers should be made to his specifications and gages. I would ask: Is he consistent as regards standardization?

Dexter, Maine. E. W. TATE.

Constants for Planing Time

In the article by W. R. Gardiner, which appeared in Vol. 36, page 674, entitled "Constants for Planing Time," I notice that the author has fallen into the somewhat common error of assuming that the average speed of a planer table for the round trip can be obtained by adding the cutting speed, expressed in feet per minute, to the return speed, and divide the sum by 2. That this method is wrong can be seen by the following example:

Suppose we have a planer running 25 ft. per minute on the cutting stroke, and 100 ft. per minute on the return, and set for a stroke 25 ft. long. Under these conditions the time consumed for the cutting stroke would be one minute, and for the return 0.25 of a minute, or 1.25 minutes for the round trip.

The average speed for the round trip would be found by dividing the total time consumed for the round trip (1.25) into the total length traveled on one round trip (50 ft.). This gives an average speed of 40 ft. per minute.

Mr. Gardiner's method of computing the average speed for the round trip would be as follows:

$$\frac{100 + 25}{2} = 62.5 \text{ ft. per min.}$$

and the time for the round trip would equal 0.80 of a minute. Comparing the two methods, the correct one gives 40

ft. average speed, and 1.25 minutes for the round trip.

Mr. Gardiner's method gives 62.5 ft. average speed, and 0.80 minute for the round trip. This is a serious difference, as seen in the example on page 674, where the time required to plane a surface 50x 10 in. is given as 32.5 minutes, whereas if the average speed was computed correctly, it would be 47.5 minutes, all other conditions remaining the same.

This would amount to a difference of 190 minutes in one day, and would result in piece or premium rates being set so low that the task of the operator would be impossible of accomplishment, causing dissatisfaction and lack of confidence in the ability of the rate setter, with the whole train of evils that would follow.

This very condition arose in the plant of which I am superintendent. The premium time was set on planing a job which the foreman and operator declared impossible of fulfillment. After considerable friction, the matter was finally placed before me, and after careful investigation the very mistake here explained was discovered. After this was corrected the premium rate was found to be all right.

If the table given on page 675 is based upon this incorrect assumption, you can readily see that it is valueless, and the only reason for this criticism is that the mistake shall not be perpetuated and cause mischief.

In our plant we use a slide rule, designed by George Langen, of the Cincinnati Planer Co., which enables any person of ordinary intelligence to arrive at the correct cutting time of any planer job in a few seconds, when the speed of the cutting and return stroke, the feed to be employed, and the area of the surface to be planed, are known.

J. A. Le Blond,
Superintendent.
The R. K. Le Blond Machine Tool Co.
Cincinnati, Ohio.

Making Forming Tool

I was interested in reading J. S. Atkinson's article on this subject at page 217. His idea of setting the tool blank at the angle of clearance in the shaper vise is theoretically good, and new to me. The idea as applied to forming a male form tool seems to be about the best way out of a job usually considered "awkward." I differ from him, however, as to the advisability of employing the same method for making a female tool.

In an article written by me, some time ago I described the way in which I made a forming tool for some knuckle-joint ball-end pieces. This tool was bored so that when placed flat in the tool post, it produced a true ball. The tool was also capable of being ground down to the lowest limits compatible with strength, and maintaining its form. The blank was set square to the ways of the lathe and fed by the compound rest which was set to the angle of clearance required.

Of course, setting the blank at the angle of clearance to the ways, and feeding parallel by means of the saddle, will secure the true circular bore in the tool blank, and the "ball" of elliptical, longitudinal cross-section that Mr. Atkinson describes.

In my old T-slot mill, turned up to the diameter and pointed on the edge, I have a tool that generates a circular path, instead of a reciprocating, wide-faced, forming tool, which I think must have a certain slight tendency to chatter and drag, in spite of Mr. Atkinson's precautions.

Errors, owing to unequal wear on the shaping tool (or equal wear for that matter) will be faithfully copied on the form-tool blank being machined, and if the tool blank should shift a little in the shaper vise, and the angle of the blank in relation to the shaper tool be altered, all the accuracy which your correspondent is striving after will be lost. Perhaps, however, he has a jig which will insure the blank against shifting.

By my method one can, by setting the compound rest to the desired angle, obtain any angle of clearance. Mr. Atkinson would have to alter the angle of his special tool-holder every time he wished to alter his clearance.

Of course, an angle of clearance can be decided on, and adhered to for general work on similar material, so perhaps it is not such a great advantage to alter this, but it is handy to be able to do so when you happen to have some special material to machine which may require a tool with more or less clearance than usual.

George R. Thatcher.
Bedfordshire, England.

Spring Box Problem

In Vol. 36, page 531, of the American Machinist, P. Steiner asks for the diameter of a spring box and the length of a spring $\frac{1}{2}$ in. thick, to give $3\frac{1}{2}$ turns, the arbor being $1\frac{1}{4}$ in. in diameter. If he makes the internal diameter of the spring box $2\frac{1}{16}$ in., and the spring about 63 in. long, he will not be far from correct.

The number of turns available for work is the difference between the number of coils when wound tightly on the arbor, and the number of coils when expanded against the wall of the spring box. This number is at its maximum value when the length of the spring is such that the outer diameter of the spring when fully wound is equal to its inner diameter when relaxed as much as the spring box will admit of. Or, in other words, the area of the end view of the spring when wound or relaxed should be equal to the area of the empty annular space in the spring box.

The area of a circle $2\frac{1}{16}$ in. in diameter is 5.1576 in. and of a circle $1\frac{1}{4}$ in. in diameter is 1.2272. The mean of these is 3.1922 in., which is the area of a circle 2.016 in. in diameter, which is the outer or inner diameter of the spring in its wound or relaxed positions, respectively. The difference between the outer and inner diameters, divided by $\frac{1}{16}$ in., will give the number of coils of the spring in each position. Subtracting $1\frac{1}{4}$ in. from 2.016 in. and dividing by $\frac{1}{16}$ in., we get about $12\frac{1}{4}$ as the number of coils when fully wound. Subtracting 2.016 in. from $2\frac{1}{16}$ in. and dividing by $\frac{1}{16}$ in., we get about $8\frac{3}{4}$ as the number of coils when relaxed, and the difference between $12\frac{1}{4}$ and $8\frac{3}{4}$ is $3\frac{1}{2}$, the number of turns of the spring box that is available for work.

The length of the spring is found by multiplying the mean of the outer and inner diameters by 3.1416 and also by the number of coils. Of course, it is advisable to have some margin beyond the actual number of turns required, and Mr. Steiner may have included this margin in his $3\frac{1}{2}$ turns, but in case he did not, then he would better make his spring box a trifle larger than $2\frac{1}{16}$ in. and his spring somewhat longer than 63 inches.

Walter Gribben.
Brooklyn, N. Y.

Recovering Blueprints

In Vol. 36, page 306, J. M. Henry says he uses bichromate of potassium for intensifying blueprints. I use the following solution for prints which are over-exposed and would otherwise have to be scrapped:

Make a stock solution of $\frac{1}{2}$ lb. ferro perchloride dissolved in $\frac{1}{2}$ gal. of water and dilute about 20 to 1 for use.

Prints which are practically invisible will be recovered by this method although it is not so good for under-exposed prints. The iron in the solution, of course, affects the portions most exposed.

M. Locke.
Manchester, England.

Copper and copper manufactures imported into and exported from the United States in the fiscal year 1912 will approximate 150 million dollars in value, or more than 10 times the total of 1892 and almost $2\frac{1}{2}$ times that of 1902. Figures compiled by the Bureau of Statistics, Department of Commerce and Labor, show that during the nine months ending with March imports of copper, including both ore and manufactures, aggregated $31\frac{1}{2}$ million dollars, and exports 86 million. The world's production of copper in 1911 is estimated at 873,460 tons of which the United States is credited with 492,650 tons.

The Association of Manufacturers

The seventeenth annual meeting of the National Association of Manufacturers was held at the Waldorf-Astoria Hotel, New York City, May 20, 21 and 22. The usual routine business was transacted and a large number of instructive addresses listened to. For the purpose of this brief report, only a few matters can be considered.

In annual convention the association declares for accident prevention and compensation, urges action to provide industrial education for our boys and girls, and calls attention to the need of fire prevention in this country.

Accident Prevention and Compensation

The greater part of the discussion at the convention last year dealt with workmen's compensation and the prevention of industrial accidents. This subject again occupied an important place on the program. Mr. Schwedtnan presented the report of the Committee on Industrial Indemnity Insurance and outlined the work that had been done during the past year. Many addresses have been made by members of this committee, pamphlets, circulars and other literature have been distributed and the activities of the association through this committee have been directed toward the adoption of the principle of accident compensation as opposed to employers' liability.

A resolution was formally adopted, reasserting that the association stood firmly for accident prevention and workmen's compensation in future legislation. A recommendation was made to appoint a new committee to take up this work and carry it along the following lines:

First: Continuous and close relations with state and federal legislators, legislative committees or commissions engaged in drafting new employers' liability or workmen's compensation laws.

Second: Close coöperation with organizations, national, state or local, that are interested in voluntary or compulsory compensation schemes for injured workers.

Third: Advice to members of our association on voluntary relief systems, liability, compensation or accident prevention and legislation on all these subjects.

Fourth: A general educational campaign among the public, the newspapers, the colleges, and business and professional men in general, through the aid of addresses, illustrated talks, circulars and letters, all in the furtherance of our accepted principles for a sound workmen's compensation system.

Fifth: A vigorous general campaign for the prompt adoption of statistical systems of work accidents so that at the earliest moment we may secure facts instead of guesswork to build upon.

Sixth: A special campaign among state factory inspectors to the end of securing higher ability and efficiency and less political influence.

Seventh: Encouragement of mutual insurance organizations and close cooperation with existing insurance concerns with a view of securing rates for our members in proportion to their accident-prevention efforts.

Finally: Bearing in mind the special need of popular education on the subject of accident prevention and relief, we recommend that a vigorous campaign for accident prevention be inaugurated by coöperation with our members and other organizations with the aid of illustrations, including lantern slides and motion pictures.

There were two other features of the convention that dealt with this broad subject. An exhibition of photographs and models of methods and devices for safeguarding machines and operations was presented in a room adjacent to the convention hall. This exhibition followed the lines of the one seen last year, but was more thoroughly and carefully worked out and more representative of the work being done in this country.

The other feature was an innovation. In the late afternoon of the first day of the convention, a special program, consisting of brief talks and motion pictures, was given to the members of the convention and factory superintendents and foremen from the vicinity of New York. These pictures were prepared under the auspices of the association, and it is expected that they will be exhibited in the moving picture theaters of the country.

The first picture, somewhat sentimental in character, showed the cause and effect of a serious industrial accident, and carried the lesson of personal care on the part of the workman in guarding himself from injury. The second showed safety devices in use in the plant of the Brown & Sharpe Manufacturing Co., Providence, R. I. The third illustrated a number of factory fire drills in plants in the State of New Jersey.

New Jersey today stands as the most progressive state in the Union in its requirements for fire protection, fire drills and provisions for safeguarding life in factories in case of fire. The fourth picture showed a lifeboat drill on an ocean liner.

It is extremely gratifying to note this continued adherence to the principle of workmen's compensation, as opposed to employers' liability. Employers' liability as such is nearly a dead issue in this country.

Industrial Education

The Committee on Industrial Education presented an extremely able and complete report in line with other reports on this same subject in years past. It pointed out that America is supposed to be a nation which educates its children. As a matter of fact half of all American children leave school at the end of the sixth grade or at about 14 years of age. They have only learned the "Three Rs," which are not an education in themselves, but only a means whereby education can be had. This is a situation that the American people are called upon to remedy.

An appeal was made to the members of the association to lend their influence in solving this great problem, which must be handled right in order that we may have a working population to carry on the industries of the country.

Fire Prevention

One of the best appreciated addresses of the convention was delivered by Franklin H. Wentworth, secretary of the National Fire Protective Association.

He pointed out that the fire waste touches the pocket of every man, woman and child in the nation. It strikes as surely, but as quietly as indirect taxation. It merges with the cost of everything we eat, drink and wear.

The profligate burning every year of $250,000,000 in value of the work of men's hands means the inevitable impoverishment of the nation. What, if we were to lose that sum annually out of the national treasury or in wheat, or corn, or cotton! A loss of $250,000,000 a year means approximately $30,000 per hour for every hour of the 24. We are burning the equivalent of a $5000 home every 10 minutes. This fearful loss spread over the entire business world of America is beginning to manifest its impoverishment.

This ever-present conflagration hazard makes an approach to scientific underwriting impossible. The hazard is not confined to any particular state. It is present in every state, in every city, and in every town in the union. Our buildings in this country are largely of wood and sooner or later we must pay the penalty for inflammable construction unless we find some way in which to reduce our hazards. The fire-resisting window in a fire-resisting structure was suggested as one of the means whereby this conflagration problem might be solved, not absolutely, but relatively.

Brick and stone buildings are logical and capable fire stops if the fire can be kept out of them. If a small city or town will trace out a maltese cross of

such buildings dividing the city into sections and equip these buildings with metal window frames and wire glass, there will at once be set up an equivalent of substantial fire walls crossing at right angles. This fire-protection device, simple, inexpensive, and yet scientifically planned may save a city from destruction.

Mr. Wentworth stated that eventually we must come to the equipment of all commercial factory and office buildings with metal window frames and wire glass. When this condition has been reached, we will have abolished the great conflagration hazard which now menaces our cities. Fires then will be unit fires, which can be extinguished by the fire department within the buildings in which they originate, instead of spreading to adjoining structures and perhaps reaching acres or square miles of territory.

The American people are awakening very slowly to a comprehension of this problem and its solution. During the past year, however, interest has been manifested by the observation of "Fire Prevention Day" in many of the states, by the appointment of fire marshals and the amendment of fire-marshal laws, by teaching of the fire hazard in public schools and by a change of viewpoint which now regards city and town fire departments as bureaus of prevention as well as corps for extinguishing.

Consular Reforms

The committee on this subject reiterated the need of this reform and stated that the outlook is favorable for H. R. bill 20,044 for the improvement of the foreign service. This bill, known as the Sulzer Bill, has the tentative indorsement of the committee. The formal resolution reads as follows:

Resolved, that the prosperity of our country depends, in a large part, in the proper extension of our foreign trade. That for the proper development of that trade in the interests of the American nation we must have a foreign service staff trained in its duties, alive to the conditions, and business-like in its activities, which shall be free from partisan influences and which shall be appointed, transferred and promoted solely on an efficiency and merit basis.

Resolved, that for the furtherance of this spirit proper compensation should be provided for our foreign representatives and their staffs down to the lowest clerks so that our foreign offices will be completely Americanized in their personnel.

Resolved, that steps be taken at the earliest opportunity to provide government owned quarters, appropriate to the dignity of the country in the various countries of the world.

John Kirby, Jr., was reëlected president of the association, and A. B. See, treasurer, to fill the vacancy caused by the death of F. H. Stillman.

An Internal Gear Cutting and Two Babbitting Devices

Among the many devices which W. C. Kirk, of the Patten Manufacturing Co., Chattanooga, Tenn., has in his shop for facilitating the work, is an attachment which he has put on a Gould & Eberhardt gear cutter for cutting internal teeth in a large gear ring, used on a hoist this firm builds. This attachment is shown in Fig. 1.

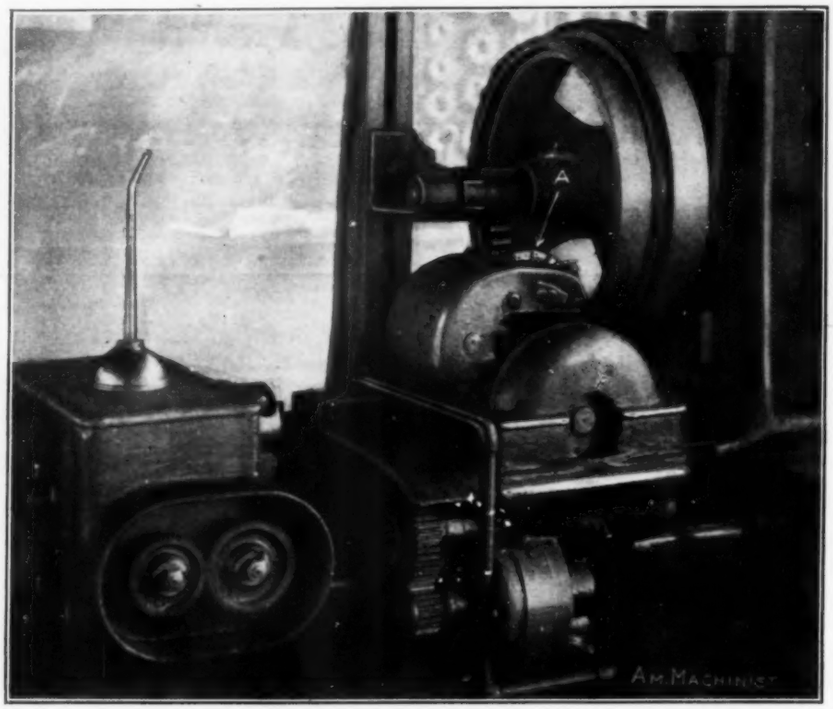


Fig. 1. Internal Gear-cutting Attachment

A gear is placed on the regular cutter spindle, and this runs the cutter *A* through a chain of intermediate gears. This attachment is very convenient for many large internal-gear jobs where there is sufficient clearance at the back of the teeth for the cutter.

Babbitting Jigs

The main bearings on the bed of the hoist are babbitted with the device shown in Fig. 2. This jig has a bracket *A*, which fits the machined pad between the bearings. The bolting of the bracket to this finished pad brings the mandrel shoulders into correct position to cast the bearings the right distance from the center.

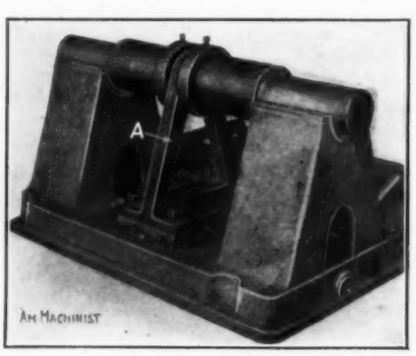


Fig. 2. Main-bearing Babbitting Jig for for an Electric Hoist

A method of casting solid babbitt bushings is illustrated in Fig. 3. Two of the bushings are shown at *A* and *B*, the mold for *A* being shown at *C* and the mold for *B*, disassembled at *D*, *E* and *F*.

As shown, the mold consists of a base into which is set a mandrel, the base being recessed to center a sleeve, over the top of which a cap is placed. Holes for pouring in the babbitt are shown in the caps at *G* and *H*. Bushings made in this way are easily pressed into place in a worn pulley, bored out to receive them.

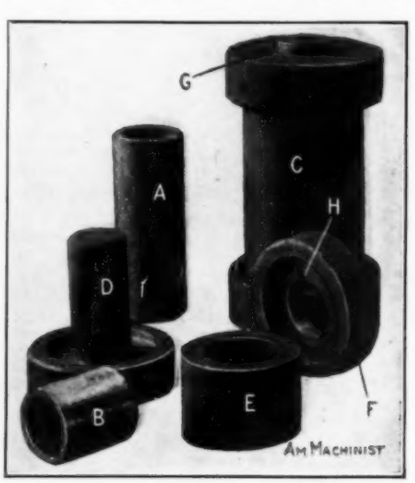


Fig. 3. Babbitt Bushing Molds

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OUTLINE OF TOPICS, PAGE 153

American Machinist

Standardization of Machine Tools

This subject has received considerable attention during the past six months, as shown by the articles and discussions in our columns. In none of these has the viewpoint of the machine builder been taken.

James H. Herron, the recently appointed general manager of the National Machine Tool Builders' Association, however, did take this position in his address at the Atlantic City convention. His argument was that standardization will "lessen the cost of manufacture in the plants of the members of this association."

The reasons advanced for this possible lessening in cost are: Improvement in design through the adoption of proportions worked out from careful analysis instead of by haphazard methods; reducing of small-tool equipments, jigs, fixtures and the like, and the accompanying confusion in their use; establishing uniformity in raw materials, thus permitting manufacturers and dealers to carry a more extensive stock, though of fewer sizes and kinds; lessening the cost of raw materials through producing in larger quantities. All of these advantages are within reach.

There is still another that should be mentioned: A metal-working machine conforming to the standards of the National Machine Tool Builders' Association will have a strong selling point, which is today possessed by none. This is the reflex of the advantages of such standardization to the users.

The association is to be heartily commended for its action in appointing a commission to study this subject. It is undoubtedly one of the most constructive steps that could be taken. We sincerely hope that the work will progress as rapidly as possible, consistent with thoroughness. The results we feel confident will be accepted as authoritative by machinery builders generally.

Machine Tools A Necessity

In his address at the Atlantic City Convention, Charles E. Hildreth stated an economic proposition that can well be emphasized. Referring to the machine-tool building industry, he said:

> In one way we have the most stable business known, for there is not a thing the people wear, eat or have as a luxury that is not dependable for its existence on the machines we make.

Machine tools are today a necessity. The comforts of everyday life come from the use of machinery. Behind the machinery producing every article of common consumption is the machine tool. The master of both is the machinist.

One of the greatest elements in our education is its foundation in the idea of service. A man is expected to do something worthy. The increase of human comfort is a highly worthy object. Tracing back, we have this comfort coming from the use of machinery, machinery made possible by the development of machine tools, and all machinery a product of the machinist's ability. The line of descent is direct from the work of the machine-tool maker to the comfort of the individual.

Any industry founded on a necessity has a strong element of stability. Thus the quotation above is amply justified. Machine-tool building has a most stable foundation from an economic viewpoint. Indirect proof of this lies in the fewness of the failures that have been recorded. The means of making machinery —machine tools—are a necessity.

Fire Hazard Controllable

The fire hazard in factories is practically controllable. This fact has been demonstrated in the experience of great mutual fire insurance companies. It is now only necessary to follow the methods and spirit of prevention which have been demonstrated as effective.

The greater part of this experience has been accumulated from textile mills, although there have been some disastrous machine-shop fires. From a book recently issued by the Arkwright Mutual Fire Insurance Co., entitled "Factory Mutual Insurance," we take a number of illustrations pointing out some of the less readily recognized hazards, and preventative measures that should be taken:

Times when repairs are being made, particularly to any part of the fire-fighting apparatus, seem to be especially hazardous. A cotton mill in Rhode Island was totally destroyed by a fire started from an open light by igniting some benzine on a stone floor. The factory had been stopped for about two weeks to repair the waterwheel. The work had not been completed, thus the force pump driven from the wheels could not be used.

A machinist repairing waterwheel gears in a mill in Massachusetts knocked his lantern into the oil-soaked wooden box around the gears. A fire was started and as the force pump was alongside the waterwheel it could not be reached. The resulting loss was $520,000.

The lessons to be drawn are the danger from repair work, the need of two men working together, and the hazard from surroundings that can rapidly spread fire.

In another Massachusetts mill a fire entailing a loss of $205,000 was started by a stone mason using a gas lamp while working in the engine-room. Belt holes served as flues to other rooms. The engine-room had no sprinklers and the main pump could not be reached and started because of the fire.

A mill in Connecticut burned on Thanksgiving Day with a loss of $160,000. It was partly provided with perforated pipe sprinklers to be supplied by water from a steam pump. However, steam was not kept up on holidays and the sprinkler service was inoperative.

A plant in Rhode Island was burned by fire started about midnight and at a time when the rotary fire pump had been disconnected for repairs.

Fire started in a mill engine-room about 7 p.m., probably from ignition of the wooden lagging on the engine cylinders. The room was not provided with sprinklers although the main part of the plant

was so equipped. Steam for the fire pump was carried by a pipe running through the engine-room with a valve in that room. This valve was kept open during the day but, due to an ill-advised desire to save condensation, it was closed by the watchman on his first round at night. Thus the more effective part of the fire-fighting apparatus was inoperative and the plant was burned with a loss of $930,000. The closed engine-room valve was found in the ruins.

In 1896 a part of the plant of the Washburn & Moen Manufacturing Co., Worcester, Mass., was burned with a loss of $150,000. The fire started on Sunday morning when repairs were being made to fuel-oil pipes in a building used for making and tempering steel springs. There were no automatic sprinklers in the part where the fire originated.

The intense heat quickly softened the steel columns, allowing the floors and roof to fall into a tangled mass, which burned with great rapidity, totally destroying the building.

This fire showed the danger from overhead oil pipes fed by gravity; the great rapidity and seriousness of fire in oils; the danger of oil-soaked floors, and the need of automatic sprinklers, even if there is little in the construction of the building to burn. Further, unprotected steel work is vulnerable and needs protection in the main members if a safe structure is to be secured.

In 1895 the machine shop of the Crocker-Wheeler Electric Co., Ampere, N. J., burned with a loss of $250,000. There were automatic sprinklers over about two-thirds of the plant but the water supply from the public mains was weak.

The danger from open belt holes and belt boxes was shown by a fire in New Hampshire in 1906, which entailed a loss of $480,000. About 6:20 a.m. a sprinkler on a fourth floor broke open from an unknown cause and the water supply in half of the mill was shut off by closing a valve. A few minutes later fire was seen around a belt box in the third story under this sprinkler and word was sent to open the closed valve.

The fire spread very rapidly through the greasy belt boxes, fanned by the moving belts. In the succeeding excitement the valves controlling the sprinkler supplies were not opened for 10 to 15 minutes.

This fire was probably caused by the friction of the main belt rubbing against the boxing, it having possibly slipped on account of being wet with water from the sprinkler which opened first.

Still another fire started in a plant on Sunday forenoon when work was being done about the main engine flywheel and on the throttle valve of the main fire pump. The fire spread rapidly, running along the main belt to the floor above. The fire-pump valve was put together as quickly as possible and the pump started. The fire was finally extinguished but the loss was $131,000.

These fires show the hazard from repair work in general and particularly from repair work to the fire-fighting apparatus. Extreme care should be taken when such work is under way. No one man should work alone. If lights or torches are used buckets of water or fire extinguishers should be alongside in case a fire should be accidentally started.

The fire hazard from repair work is not self-evident but it is very real. The hazard from a room in a plant which is not sprinkled is well shown by a fire in the machine shop of Burnham, Williams & Co., Philadelphia, Penn., in 1907.

The fire started about 5:30 p.m. in a section partitioned off for a drafting-room and not provided with sprinklers. It quickly broke out into the main room where the sprinklers happened to be shut off. The start gained in these unprotected areas was sufficient to bring about a loss of $140,000. The fire was probably caused by a draftsman who lit his pipe or cigar as he left the drafting-room.

It is sometimes argued that there is so little combustible material in machine shops that there is little danger from fire. That this is fallacious is shown by a fire in the plant of Henry Disston & Sons Co., Philadelphia, Penn., with a loss of $173,000. We quote: "The heavy machinery was damaged much more than was thought possible with the smalf amount of fuel there was to burn."

The cases cited above are all of large losses and have been given to emphasize certain hazards.

We have called attention in these columns to the value of automatic sprinklers. This is further emphasized by the following tabulation compiled from records of fires in works insured by the mutual companies for the ten-year period 1877 to 1887. This was a period during which sprinklers were being installed in many plants and, therefore, gave an opportunity to compare the results of fires under both sprinkled and unsprinkled conditions.

Total fires without automatic sprinklers.	759
Total loss	$5,707,000
Loss per fire	$7,500
Total fires with automatic sprinklers	206
Total loss	$87,600
Loss per fire	$425

It is roughly estimated that during this period about one-quarter of the property insured had sprinklers. Thus we have these comparisons. A loss 17 times greater per fire without sprinklers than with, and a total loss of $87,600 on one-quarter of the list that was sprinkled against a loss of $1,900,000 for each quarter unsprinkled. The comparisons teach a lesosn.

The great value of the automatic sprinkler lies in the fact that it is on duty 24 hours a day and every day of the year. It works in out-of-the-way places, in the dark, in smoke, amid fire, and reaches places where men with hose lines cannot go. It is on hand to put out a fire when it should be put out—when it starts.

But important as sprinklers are they are not the only safeguards that should be introduced. Fire walls with automatic fire doors are secondary barriers of great value. The general construction should be strong, substantial and of fire-resisting materials. The danger from unprotected steel in main members of a machine-shop building has been emphasized. This hazard is the greater as manufacturing areas increase.

Many machine shops built within the last few years have been of single-story construction with a light-steel, trussed roof covering a single large floor. It is gratifying to note that as a rule these buildings were provided with sprinklers when erected.

There are many machine shops, however, where the fire-fighting apparatus is inadequate and where prevention is not properly considered. We have pointed out some of the unusual hazards and some of the successful means of prevention, but with all must come careful, periodic inspection. Vigilance is the continuous element in the price of fire prevention.

PERSONAL

William T. Elzinga, for the past four years instructor of industrial arts at the Stout Institute for Manual Training Teachers, Menominee, Wis., has resigned in order to enter the field in Richmond, Va.

Paul C. Van Zandt, formerly district manager of the Stephens-Adamson Manufacturing Co., Chicago, Ill., has accepted a position as mechanical engineer with the Chicago office of the Allis-Chalmers Co.

William R. Huttinger, until recently superintendent of the machine shop of the Trenton Malleable Iron Co., Trenton, N. J., has become assistant engineer of the Bessemer Gas Engine Co., Grove City, Penn.

Joseph Tracy and Henry F. Donaldson have become associated as automobile engineers and will carry on a consulting practice in research, design, development and construction work at 1786 Broadway, New York City.

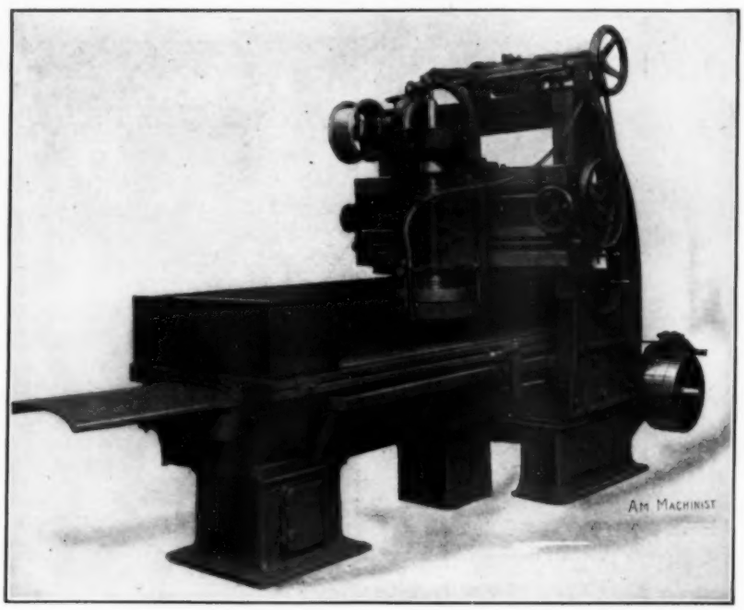
Anson W. Richards, for many years connected with Manning, Maxwell & Moore, and for the past six years their representative in Japan, is now connected with Bararque de Almeida & Co., Rio de Janeiro, Brazil. He will look after the interests of American machinery in that territory, and is now in this country making agency arrangements. His headquarters are at 17 State St., New York City.

Shop Equipment News

Brief illustrated descriptions of new or improved machines, tools and shop appliances—prepared by the editors

Vertical Grinding Planer with Movable Head

The type of grinder shown herewith was recently designed by the Springfield Manufacturing Co., Bridgeport, Conn., for grinding a large variety of work.



VERTICAL GRINDING PLANER WITH MOVABLE HEAD

The wheel head is mounted on a heavy crossrail, which has a cross movement of 36 in., and is traversed back and forth by means of a screw and crank handle, as shown on the right end of the rail. The wheel head has a quick hand motion by means of the large handwheel shown, and a slow or feeding motion by means of the small handwheel, which engages with a worm and worm gear that can be easily disengaged.

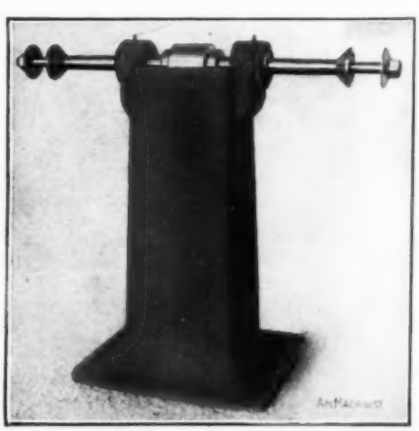
The wheel head travels on narrow guides. The wheel is 16 in. in diameter and is driven by a pair of bevel gears, one being of cast iron and the other rawhide. All the high-speed bearings are either of the self-oiling type or sight feed. The end thrust bearings are all provided with ball bearings.

The raising and lowering is accomplished by means of the usual straight and cross belts. The same drive is also used for traversing the table through worm and worm gear, and a large coarse-pitch screw operating in a nut 15 in. long.

The machine is equipped with a pump and all necessary attachments, as well as a water guard. The front section of the guard is shown removed; it is made in two sections, so that it can be easily taken out and put back by sliding it in from the top and clamping with the thumb-nuts. The machine can grind stock 30 in. wide and 7 ft. long, and weighs 13,450 pounds.

Ball Bearing Polishing Stand

This machine and countershaft are fitted throughout with ball bearings. The diameter of the spindle at the radial load is 2 in. and tapers down to 1¾ in. The arbor is 1¼ in. in diameter, forming a shoulder for the 4½-in. diameter wheel collar. The spindle extends 15 in. on each side of the base and is 39 in. from the floor. The spindle pulley is 5 in. in diameter by 4½-in. face. The two radial ball bearings are protected by special cases and are lubricated by compression grease cups. Spacing collars are furnished, to be used when wheels of various widths are required.



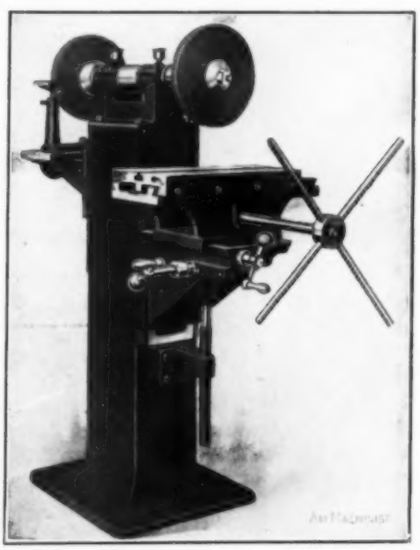
BALL-BEARING POLISHING STAND

The weight of the machine, complete with countershaft, is 600 lb. It is a recent design of the Gardner Machine Co., Beloit, Wis.

Hand Feed Surface Grinder

The halftone shows one of a line of five styles and sizes of surface grinders, recently developed by the Northampton Emery Wheel Co., Leeds, Mass.

The feed is graduated in thousandths, and the bearings are of high-carbon steel, made dustproof. The wheel at the left



HAND-WHEEL SURFACE GRINDER

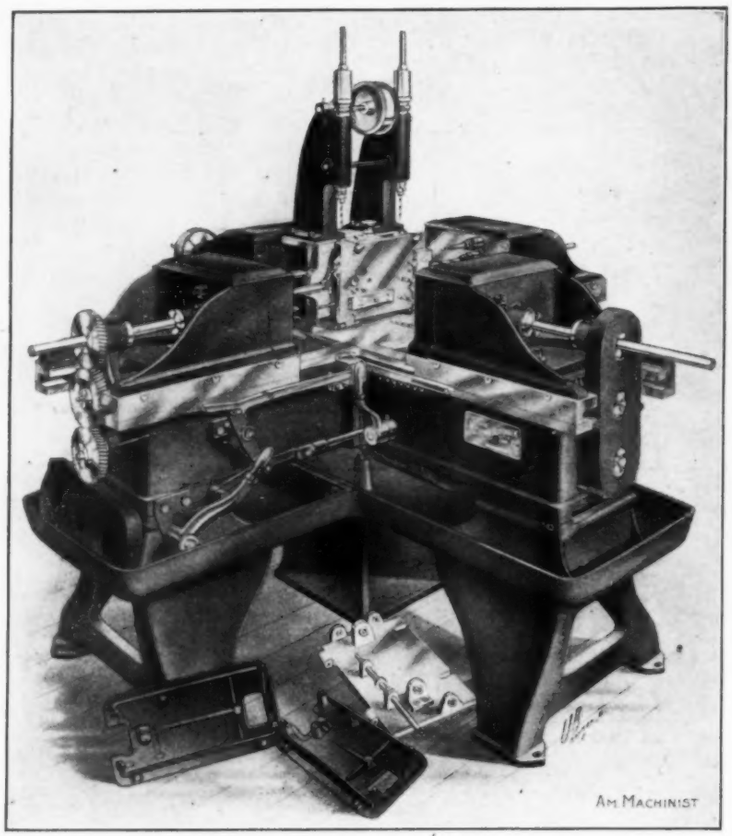
of the machine is arranged with hand rest, for doing hand work, and the table on this side can also be raised and lowered.

The table at the right is ground with its own wheel, so as to insure parallelism. It is accurately gibbed, so that wear can be taken up. The handwheel at the right travels back and forth 4 in. to each quarter turn of the handle, and the table travels the capacity of the machine, 16 in., with one revolution of the handwheel.

The surfacing table is 9x16 in., carries a wheel 12x1 in., and the space between the wheel and the surfacing table is 7 in. This machine weighs 700 pounds.

Horizontal Multiple-Spindle Drilling Machine

The machine shown is designed to drill in 2, 3, 4 or 5 directions simultaneously. It is provided with a change-feed mechanism and with either plain or rotating table, adapted to carry either 1, 2, 3 or 4 jigs. High-speed drills are used.



HORIZONTAL MULTIPLE-SPINDLE DRILLING MACHINE

The table has an automatic indexing mechanism and is equipped with a friction-clutch pulley, having an automatic throw-out. An endless track encircles the cam drum, which is generated for a fast forward, a slow or drill feed and a quick return.

The cluster boxes are removable, so that additional boxes can be used on one machine for drilling different parts. The boxes are doweled and fastened to the slides and carry the spindles, spindle gears and idlers.

The power is delivered from the rear of the machine and is transmitted to the several ways by means of large miter gears. Spiral steel gears and rawhide idlers are used to transmit the power to the shafts, which run the spindles.

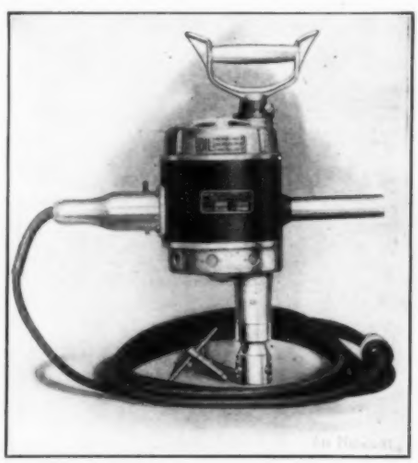
This machine is a recent product of the National Automatic Tool Co., Richmond, Ind.

Portable Electric Drilling Machine

This portable electric drilling machine is made as light as practicable, consistent with maximum power.

The armature shaft runs in ball bearings, while the gears are of hard steel and Parsons bronze. A ball-bearing thrust, protected by a dust cap, is used, in order to prevent wear and friction when the tool is pressed against the material to be drilled.

The motor is air cooled by forced lubrication, and instant control is obtained by a quick-break switch in one of the side handles. The other side handle unscrews and the chuck is off-center, permitting the drill to be used in close quarters.



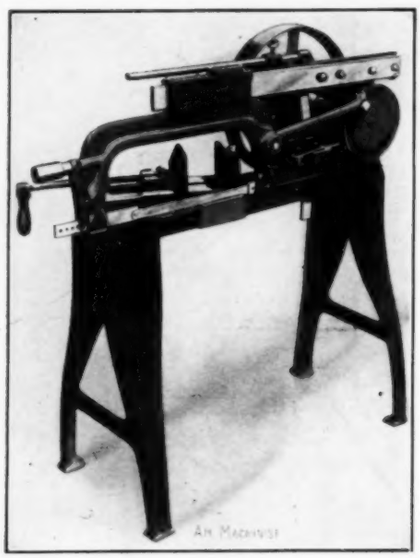
PORTABLE ELECTRIC DRILLING MACHINE

This machine is a recent development of the American Electric Tool Co., West Newton, Mass.

Power Saw

The power saw shown was recently developed by the W. Robertson Machine & Foundry Co., 32 Greenwood Place, Buffalo, N. Y.

The bed is one casting-box pattern with surfaces milled true and parallel. The head is milled on the base to fit the housing. The frame is supported on a finished steel arm having a long milled bearing. It is mounted in the center of the support and driven from the center to the crankpin. The frame takes 10-, 12- and 14-in. blades, cutting on the draw stroke and releasing on the out stroke.

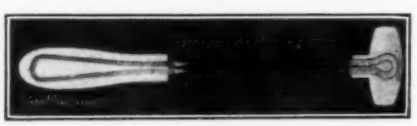


POWER SAW

Soft Hammer

The halftone makes clear the construction of this hammer.

The handle is made of tempered bessemer steel, cast as shown, in a light special metal. The ball of the hammer may be cast of soft material, according to the idea of the user, although experience has taught the maker that a combination of lead and babbitt, in pro-



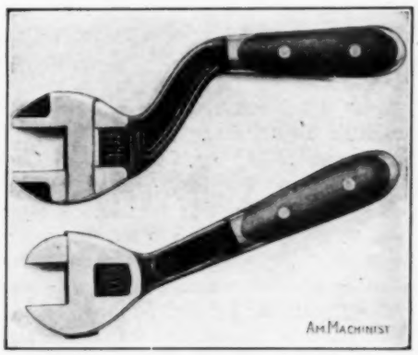
SOFT HAMMER

portions of 4 to 1, is best suited for general work.

This hammer is a recent product of Charles Herzog, 44 Reed Place, Detroit, Mich.

Two Drop Forged Wrenches

The halftone shows adjustable S and straight-handled drop-forged wrenches, recently produced by the H. D. Smith & Co., Plantsville, Conn.



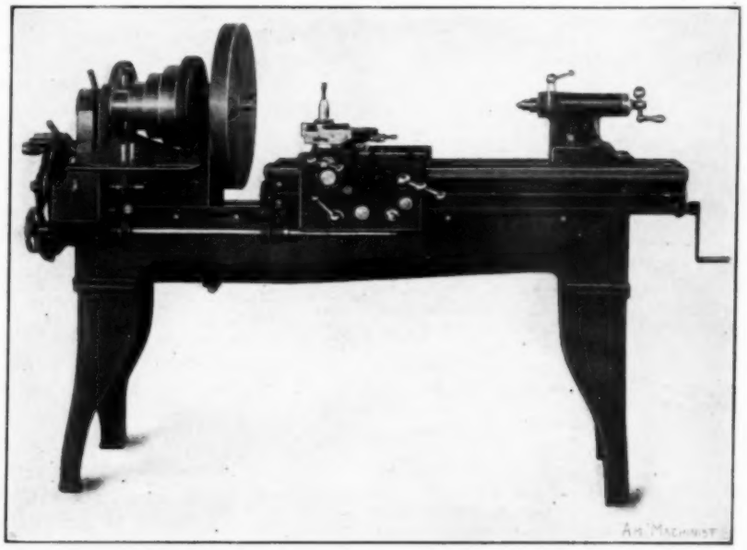
ADJUSTABLE S AND STRAIGHT-HANDLE WRENCH

The illustration makes unnecessary descriptive details of design and construction.

Sliding Extension Gap Lathe

The halftone shows a 14x24-in. extension bed gap lathe recently developed by the Barnes Drill Co., Rockford, Ill.

While in the main it is similar to this firm's former 13x22-in. machine, several improvements have been incorporated. The lathe has a 2 5/16-in. spindle, through which 1½-in. stock can be taken. The cone diameters have been increased and the geared feed box gives 6 quick changes of feed.



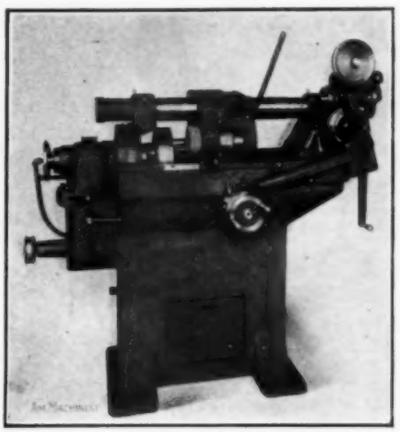
EXTENSION BED GAP LATHE

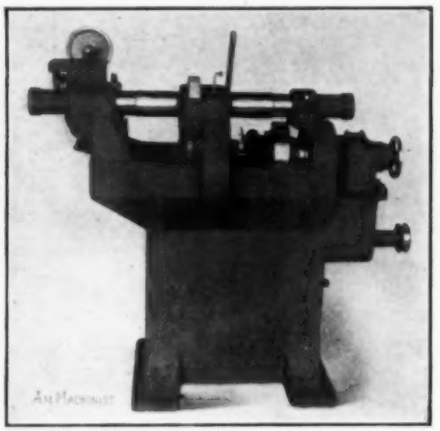
traverse for the wheel slide, assuring its permanent control and alignment.

There is no cross-slide but a swinging motion of the wheel slide about the same bearings that allow for longitudinal traverse furnishes crossfeed for diameter control.

A Hole and Face Grinder

The halftones show front and rear views of a new hole and face grinder built by the Bryant Chucking Grinder Co., Springfield, Vt. These machines have either one or two abrasive-wheel spindles and are intended for chuck work on which but one or two grinding operations are necessary at the one setting of the work.





FRONT AND REAR VIEWS OF HOLE AND FACE GRINDER

Simplicity of design has been the aim, and provision has been made only for such adjustments of motion as are actually used in general practice by the operator.

In place of the usual flat, or V-way, the wheel slide is controlled through hardened and ground cylindrical bearings so placed and protected as to make them dustproof and give smooth and even traverse for the wheel slide, assuring its permanent control and alignment.

There is no cross-slide but a swinging motion of the wheel slide about the same bearings that allow for longitudinal traverse furnishes crossfeed for diameter control.

In the grinders equipped with two wheels, (one for hole and the other for face grinding), the radial motion of the wheel slide is used to place the different spindles successively into operating position. This is accomplished with the same speed and ease with which the wheel in the single-spindle grinders is swung out of working position.

Grinders of this type are built in the following two styles: The single-spindle machine for grinding holes from 1 to 10 in. in diameter and 6 in. in length and with a diametral chuck capacity of 12 in.; and the two-spindle machine having the same capacity for hole grinding as the single-spindle grinder and carrying a second wheel spindle for face grinding. Both grinders are furnished either as power or hand-operated machines.

Crankshaft Grinding Brace

BY ROBERT R. CORNELL

The diagram shows a very simple and efficient brace which eliminates the danger of springing an automobile crankshaft when turning or grinding on throw-block centers.

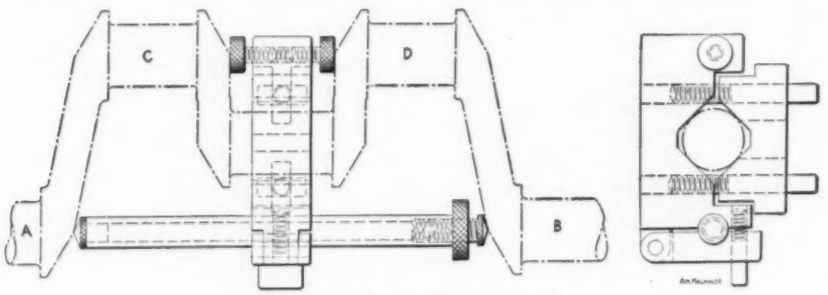
It consists of two V-blocks made of aluminum, fastened together over the center-line bearing of the shaft by two clamp-screws, sufficient clearance being allowed between these blocks for any variation which may occur in the diameter of this bearing.

One of these blocks is furnished with a hinged strap-clamp, which allows the light, hollow tube, acting as a brace rod, to be removed from, or clamped quickly into place. The rod has a knurled-head screw on one end for adjusting it between the throw webs of the shaft, and a knurled check-nut to keep it from working loose after adjustment. Two knurled-head screws on the opposite side of the block act as a brace on that side of the shaft.

After adjusting this brace to the shaft, as shown, pins *A* and *B* are ground to size. The brace rod is then removed, and pins *C* and *D* are finished in the same manner. The complete attachment may

then be removed by giving the clamp-screws a quarter turn, and the line bearings finished in the usual way in a separate operation.

The pressure against the throw-block of the grinder centers causes the shaft to spring, this spring depending to a certain extent upon the design of the shaft. When a shaft is ground in this position, the throw-pins will be out of parallel with the line bearings. This is very likely to cause the piston to slap or knock against the cylinder wall at each end of its travel. The use of this brace eliminates this trouble, and, provided it is designed to be in perfect balance on the shaft, it will also assist in preventing chatter marks and in producing true bearings quickly.



CRANKSHAFT-GRINDING BRACE

Cause of Accidents

BY ROBERT GRIMSHAW

The reports recently published by the Imperial German Insurance Department, concerning the accidents to employees of the various coöperative societies, contain many useful indications as to the causes of such accidents. Unfortunately the reports do not mention all the accidents that have occurred and been reported, but only those for which insurance or indemnity has been paid. These are almost all cases in which death has ensued, or the insured employee has been prevented from working for a period of 13 weeks or more.

The statistics give 14 different classes of causes; the number and percentage of such being as follows:

Causes	No. of cases	Per cent.
1. Motors, transmission appliances, machine tools and the like	14,094	20.3
2. Hoisting appliances elevators, cranes, windlasses, etc	3,097	4.5
3. Steam boilers, steam pipes	158	0.2
4. Explosion	552	0.7
5. Hot and caustic materials, gases and vapors	2,208	3.6
6. Collapse of buildings, breaking down and fall of machines, etc	11,012	15.5
7. Falls from ladders, stairways, etc., into hatchways and holes	10,451	15.1
8. Loading and unloading, lifting and carrying	8,630	13.0
9. Wagons, run over by, falling from, etc	4,469	6.5
10. Railway service	5,059	7.3
11. Work on board ship and traveling by water	573	0.8
12. Animals, kick, bite, etc	1,032	1.6
13. Hand tools and simple implements	4,611	6.5
14. Various	3,365	4.4
Total	69,311	100.0

It is readily seen that only 24 per cent. of these accidents are caused in "modern" work. The largest proportion of the injuries, about 45 per cent., are caused by the action of gravity, falls, lifting, carrying, etc. Transportation, wagons, railways, etc., cause about 14 per cent. of the accidents.

The statistics disprove the usual popular statements about the increase of accidents. So it seems unjust to say that the increase in the number of persons, and the increase in the size of the works, alone causes an increase in the number of injuries.

INDUSTRIAL ACCIDENTS

Accidents caused by machinery have diminished in industrial (manufacturing) pursuits, and in a still greater degree in the agricultural coöperative societies.

When we know the cause of the "technical" accidents, we know what to do in connection therewith. Here statistics prove what Dr. F. Lange wrote some years ago in the *Archiv für Soziale Gesetzgebung*:

> The regulations as to the prevention of accidents have to battle particularly with this enemy (gravity), which, indeed, is more difficult to conquer than any other. For this reason the method of combating it must consist not merely in inventing preventive measures against this group of dangers, but also, above all, to cease using men as burden carriers, as ladder and scaffold climbers; that is, to transfer all work in this particular more and more to machines.
>
> The endeavor must also tend to replace stairs, ladders, etc., as far as possible by elevators or lifts, and the loading and unloading of barrels and heavy articles, by hoisting apparatus of all sorts; vehicles drawn by animals by those propelled by steam, or still better, by electricity, etc.
>
> Technical progress will bring with it a most marked diminution in the number of accidents. The more men learn to avail themselves of the forces of Nature, the more they will learn to banish accidents. The untamed natural forces are, as statistics prove, more dangerous to mankind than the tamed.
>
> As manager and inspector of industrial plants, which effect by mechanical means all really mechanical work, men are no more subjected to the senseless acts of crude forces, but control the forces of Nature and compel them to act for them in a sensible manner.

The German Imperial Insurance Department has often incited to radical methods of preventing accidents; but under the present conditions—carrying out the insurance by the coöperative societies (the contracting organizations) this does not amount to much. Some of them, indeed, have engaged technical inspectors to oversee the work. The agricultural and forestry associations have only recently fully introduced regulations tending to reduce the number and seriousness of accidents.

THE WORKMEN'S PART

For a thorough reform in the matter of the prevention of accidents it is necessary above all things to leave to the workmen, themselves, the principal and decisive regulations. But the contracting organizations in Germany will not hear of this. The insurance regulations effect only a slight betterment of existing conditions. Until recently the workmen were only called for consultation and decision concerning the regulations having the same numerical representation and with the same rights as the representatives of the contractors. But now Section 857 of the Imperial Insurance Regulations reads:

> Every year the direction (of the contracting association) in connection with the representatives of the insured shall consider the reports of the technical inspectors, and shall adopt those suggested precautions which seem calculated to improve the regulations concerning the prevention of accidents.

It now remains for the workmen themselves to select representatives who shall properly carry out the functions entrusted to them. Unfortunately, the method of voting is rather complicated and inconvenient. The representatives are chosen by the members of the insurance committees, and these latter by the representatives of the insured. Direct choice on the part of the workmen would probably be more convenient and effective.

In any case, the lesson to be learned from the statistics offered is, that the cry raised by so many workmen that life and limb are increasingly endangered by the introduction of machinery, is unjustifiable and not based on facts; that the greatest safety to mankind is that which protects him against the uncontrolled forces of Nature and more especially against that of gravity.

According to *Werkstatts-Technik*, aluminum can be soldered to aluminum or to any other metal by using a soldering metal made from even parts of phosphor tin, zinc, beeswax and block tin melted and mixed together in the order given. The beeswax must be stirred in with a wooden stick. The mixture is cast in bars. The objects to be soldered must, of course, be clean. No flux is used. If a blowhole has to be filled, this may be done afterward with ordinary solder.

Increasing Shop Capacities

News for this department solicited, not rumors or gossip—facts

Metal Working

NEW ENGLAND STATES

The Simplex Electrical Mfg. Co., Cambridge, Mass., is contemplating the erection of a four-story factory, 53x11 ft. The estimated cost is $20,000. Kilham & Hopkins, 9 Park St., are the architects.

The C. W. Rackliffe Co., manufacturers of hardware, Holyoke, Mass., will erect a new six-story factory.

The Stanley Electric Co., Pittsfield, Mass., will erect a new factory as an addition to its plant.

Samuel M. Green, architect, Springfield, Mass., has prepared plans on which bids are being received for a factory building, in Brightwood, for the National Equipment Co. It will be L-shaped, one wing 80x360 ft., and the other 80x100 ft., both of brick, mill construction, three stories high.

Charles Napier has filed plans for a new saw factory, to be erected at 229 Armory St., Springfield, Mass., for the Napier Saw Machine Works. The estimated cost is $24,000. It will be a one-story, 50x200 ft., with an L 50x50 ft., and will be built of steel, brick and concrete. Noted May 16.

The Ashton Motor Car Co., Bridgeport, Conn., will erect a garage, 52x104 ft., on State St.

The Bristol Brass Clock Co., Bristol, Conn., has had plans prepared for the erection of an addition, 100x90 ft., to its plant. It will be of brick and steel.

I. R. Blumenthal will build a public garage, on Main St., Hartford, Conn.

The contract for the construction of a new plant on Chestnut St., for the New Britain Machine Co., New Britain, Conn., has been awarded. The buildings include two four stories, 57x150 and 56x38 ft., two one story, 38x70 ft. and 36x81 ft., an elevator shaft and stair-case tower, 34x21 ft., five stories high. One of the present buildings, 57x144 ft., will be raised three stories. Noted Mar. 21.

The New Haven Machine Screw Co., New Haven, Conn., is building a frame storehouse, 25x30 ft., on Foster St.

F. E. Hopkins, Naugatuck, Conn., will build an addition to his garage.

The Blakeslee Forging Co., Southington, Conn., will erect a new forge shop, 50x220 ft.; also a new machine shop, 30x160 ft., three stories high.

The contract will soon be awarded for an addition to building 10 at the plant of the Yale & Towne Mfg. Co., Stamford, Conn. The addition will be five stories high, 50x75 ft., of brick, and will cost about $40,000.

The Waterbury Foundry Co., Waterbury, Conn., will erect an addition to its plant, on Porter St.

MIDDLE ATLANTIC STATES

George Smythe, 247 St. Marks Ave., Brooklyn, N. Y., is having plans prepared for a two-story garage, 66x130 ft., to be erected on St. Marks and Vanderbilt Ave. The estimated cost is $15,000. Eric O. Holmgren, 371 Fulton St., Brooklyn, is the architect.

The Acme Steel & Malleable Iron Works, Military Road, Chandler St. and New York Central R.R. Belt Line, Buffalo, N. Y., has purchased a site adjoining its plant and will build an addition including a machine shop.

A one-story and basement addition, 30x75 ft., is to be built by the Cortland Forging Co., at its plant at Cortland, N. Y., from plans by Tiffany & Conrad, architects, Phelps Building, Binghamton.

The Remington Arms & Ammunition Co., of Ilion, N. Y., has awarded the contract for a new machine and tool building.

The Simonds Mfg. Co. is preparing plans for an addition to its steel mills, at Ohio St. and N. Y. Central & H. R. R.R., Lockport, N. Y. A. T. Simonds is president.

Plans have been prepared and bids are being received by C. Bauer, Jr., 6 Bedford Ave., Brooklyn, N. Y., for the construction of a one-story garage, 50x80 ft., on Jackson St., near Queen St., Long Island City, N. Y., for Benjamin Lyman. The estimated cost is $10,000.

The International Motor Service Association, 1777 Broadway, New York, N. Y., is having plans prepared for the erection of a five-story garage, on West End Ave., from 63d to 64th Sts. L. C. Holden, 103 Park Ave., New York, is the architect.

Theodore Freidenberg, New York, N. Y., contemplates converting the recently vacated Oliver Bros.' bedstead plant, in Lockport, N. Y., into a large factory for the manufacture of drill presses, lathes, shapers and other kinds of machinery.

The American Locomotive Co., New York, N. Y., is considering the erection of a plant at Hamilton, Ont. The estimated cost is $200,000.

The Vulcan Crucible Steel Co., Aliquippa, Penn., has recently finished the construction of an extension to its mill and are contemplating the installation of an electric drive and also increasing its annealing capacity.

The Apollo Sheet & Tinplate Co. will erect a plant, at Apollo, Penn. The United Engineering & Foundry Co., Farmers Building, Pittsburgh, Penn., are the engineers-in-charge.

The engine house of blast furnace No. 3 of the Brooke Iron Co., Birdsboro, Penn., was destroyed by fire, May 20. The engine house contained three large blowing engines, six pumps and the electric-light plant. Loss, $40,000.

The Standard Steel Car Co., Butler, Penn., has awarded a contract for the construction of a steel car-spring plant, to be erected in Butler. The structure will be 90x180 ft., of brick.

E. Allen Wilson, architect, Land Title Building, Philadelphia, Penn., is preparing plans for the construction of a three-story garage, brick and stone, 48x60 ft., to be erected on Monument Road, near Wynnefield, for John V. Redmond.

The Brown-Stewart Co., Philadelphia, Penn., has acquired a site and will build a structural iron working plant, to cost $25,000.

The Pittsburgh Steel Foundry Co., Pittsburgh, Penn., is enlarging its Glassport, Penn., plant, to increase its facilities for designing and manufacturing cast-steel equipment for freight-car bodies and freight-car trucks. The company has increased its capital stock to $1,000,000.

Plans have been completed for the construction of a factory for the Standard Sheet Metal Co., Washington, Penn. It will be a one-story structure, 175x80 ft., of reinforced concrete, brick and steel.

SOUTHERN STATES

Fire completely destroyed the plant of the R. W. Whitehurst Co., Norfolk, Va., manufacturer of farming supplies, on May 11. Loss, $125,000. It will be rebuilt.

The Norfolk & Western R.R. Co., Norfolk, Va., has let the contracts for a roundhouse, machine shop, store and buildings to cost $100,000.

The Wheeling Traction Co., Wheeling, W. Va., will erect a concrete and steel shop, 125x180 ft., adjoining its present car barns on Wheeling Island. The estimated cost is $100,000. G. Nagel is general manager.

The Wheeling Mold & Foundry Co., Wheeling, W. Va., has acquired a site adjoining its present factory and will construct additions to its plant.

The Charlotte Cotton Compress, Charlotte, N. C., was damaged by fire, May 16. Loss, $35,000.

The Glascock Stove & Mfg. Co., Greensboro, N. C., contemplates enlarging its plant.

The Georgia, Florida & Alabama Ry. Co. will rebuild its roundhouse, power house and machine shops, recently destroyed by fire, at Bainbridge, Ga.

C. W. Birchwood, Chicago, Ill., will remove his factory to Jacksonville, Fla., and will build on Banana St., for the manufacture of bearings for automobiles.

John Bullock, Pensacola, Fla., will erect a garage to cost $10,000.

George W. Copeland will organize a company to manufacture a patented plow, at Ensley, Ala.

The Talladega Foundry & Machine Co., Talladega, Ala., will erect a 50x100-ft. corrugated-iron building.

The Walsh & Weidner Boiler Works, Chattanooga, Tenn., will erect a new factory, 100x165 ft., for the manufacture of tanks, towers, iron work, etc.

The construction of a plant is contemplated by the Memphis Nut, Lock & Bolt Mfg. Co., Memphis, Tenn., which has been incorporated with $500,000 capital stock.

The National Mfg. & Plating Co., 133 North Third St., Louisville, Ky., is equipping a shop for the manufacture of gas fixtures and other brass specialties.

The Star Machinery & Garage Co., Bowling Green, Ohio, will equip a garage and machine shop.

A garage will be erected by M. Leitel, at 1070 Wade Park Ave., Cleveland, Ohio.

The Cleveland Hardware Co., Cleveland, Ohio, maker of automobile stampings and forgings, will build a $75,000 addition to its plant and will need machine-shop tools.

The Anchor Fence Co., Cleveland, Ohio, manufacturer of wire fence, has secured a permit for the erection of a one-story factory to cost $12,000.

The Wellman Bronze Co., Cleveland, Ohio, has secured a permit for the erection of an addition to its factory at 6017 Superior Ave.

A garage will be built by the Eddy Motor Car Co., Cincinnati, Ohio, for the manufacture and sale of automobiles.

The Vulcan Furnace Co., Warren, Ohio, has consolidated with the Columbus Machine Co., in a $500,000 manufacturing corporation and will erect a $50,000 factory building in Columbus, Ohio.

E. B. Lanman Co., Columbus, Ohio, will erect a $100,000 plant for the manufacture of nuts, hardware specialties and power press work.

The Edgemont Machine Co., Dayton, Ohio, will build a new factory, at Neiberd and National Aves.

New extensions and additions to the plant of the De Forest Sheet & Tinplate Co., Niles, Ohio, are being erected and will cost about $200,000.

The Kent Machine Co., 1401 Nicholas Bldg., Toledo, Ohio, is having plans prepared for the construction of a one-story factory, to cost $20,000. Devore & McGormley, 304 Nasby Bldg., are the architects. Noted Apr. 11.

The Glacier Mfg. Co., Pittsburgh, Penn., has decided to locate at Youngstown, Ohio, and plans are being prepared for the plant, to manufacture a new kind of refrigerator and pneumatic pumps.

Bids are being received for the construction of a plant for the Suspension Roller Bearing Co., Sandusky, Ohio.

The Champion Rivet Co., Cleveland, Ohio, has purchased 20 acres of land at East Chicago, Ind., upon which it will erect a plant costing $100,000.

The Shutree Shiner Co., Cleveland, Ohio, has been organized to make mechanical shoe-shining devices. W. A. Kilrain is the manager.

The Chambers Metal Weather Strip Co., Cleveland, Ohio, will erect a $10,000 factory building at Peru, Ind. Plans have been prepared.

The Fuel Economizer Co., Cleveland, Ohio, will erect and equip a factory to manufacture a new fuel-gas valve for gas-coke stoves, appliances and attachments for gas stoves. C. R. Bowsher is manager.

The plant of the Schroeder Headlight Co., Evansville, Ind., was damaged by fire, May 10. Loss, $40,000, partly covered by insurance.

The Briggs Detroiter Co., Detroit, Mich., has awarded the contract for the erection of a large addition to its automobile plant.

The Century Electric Motor Car Co., Detroit, Mich., will build a factory, 105x200 ft. J. Gillespie is the manager.

The Henderson Motorcycle Co., Detroit, Mich., is building a two-story factory, 65x165 ft.

The Raymond Brothers Impact Pulverizer Co., Chicago, Ill., manufacturers of pulverizer and air separating machinery, has purchased from Frederick W. Crosby the vacant ground with a frontage of 250 ft., south on Eastman St., 224 ft. west on North Branch St., and extending east to Cherry Ave., and will erect a new $100,000 plant.

The Stoddard-Dayton Co., Chicago, Ill., will build a two-story brick garage at 3987 Grand Boulevard. Plans are being drawn by H. B. Wheelock.

C. H. Thompson, Chicago, Ill., has prepared plans for a two-story brick garage at 1440 Estes Ave.

The Attica Bridge & Iron Co., which will remove to East St. Louis, Ill., from Attica, Ind., yesterday broke ground for its $1,000,000 plant, the erection of which will begin at once.

The Cowboy Tank Heater Co., Mendota, Ill., is erecting a new shop, 40x104 ft.

The Racine Mfg. Co., Racine, Wis., contemplates the erection of two large additions to its plant. The company manufactures automobile bodies, etc. Noted Apr. 4.

WEST OF THE MISSISSIPPI

Bids were received, May 18, for the construction of a one-story brick roundhouse, at Fort Madison, Iowa, for the Atchison, Topeka & Santa Fé R.R. Co. C. F. Felts, Santa Fé Building, Topeka, Kan., is chief engineer.

The Helena Light & Ry. Co., Helena, Mont., is contemplating the erection of a car barn, on Main St., at a cost of about $25,000.

The contract has been awarded for the construction of a car barn at North Kansas City, Mo., for the Kansas City, Clay County & St. Joseph Electric Ry. Co. F. W. Fratt, Midland Building, Kansas City, is president. The estimated cost is $20,000.

The Automatic Register Co., Pierce Bldg., St. Louis, Mo., is contemplating the erection of a plant in St. Louis.

Ernest Bennett, Silver City, N. M., will erect a large commercial garage and machine shop, at Spring and Bullard Sts., Silver City.

WESTERN STATES

The American Motor Car Co., 1410 Broadway, Seattle, Wash., will build an addition to its garage. F. H. Boynton is president.

The Spokane Ornamental Iron Co., East Sprague Ave. and Stone St., Spokane, Wash., has had plans prepared for the construction of an addition, 50x150 ft., to its plant. The estimated cost is $50,000.

The Winton Motor Car Co., Spokane, Wash., has purchased a site at 1421 Second Ave., and will erect a one-story garage, 126x50 ft. It will be of brick and will cost about $10,000. R. G. Bowman is manager.

R. J. Danson, Paulson Building, Spokane, Wash., will erect a one-story brick garage, at 814 Third Ave., to cost about $6000.

The Lewis & Clark Steel Co., Tacoma, Wash., recently incorporated, with a capital of $5,000,000, will erect a large steel plant on Chambers Creek, near Tacoma. M. E. Gunston and L. W. Heath are interested.

The Ford Motor Car Co., Detroit, Mich., will build a large branch factory at East Eleventh and Division Sts., Portland, Ore.

John H. Sweeney, Portland, Ore., is contemplating the construction of an automobile factory at Salem, Ore. The estimated cost is from $150,000 to $200,000.

The Long Beach Improvement Co., Longbeach, Calif., is preparing plans and will soon begin the erection of a commercial garage and repair plant, on Locust Ave., Longbeach, for W. L. Lynds.

The San Diego & Southeastern Ry. Co. is planning to purchase a site at San Diego, Calif., for the erection of machine shops, roundhouse, oil sheds and other structures.

The Bean Spray Pump Co., San José, Calif., is planning the erection of a machine shop and foundry. The estimated cost is $30,000. William Binder, Rea Building, San José, is the architect.

The Monarch Meter Co., San Diego, Calif., recently organized, will erect a plant at San Diego for the manufacture of gas appurtenances and accessories.

CANADA

The Landon Works, Ltd., Fort Erie, Ont., recently incorporated, with a capital of $20,000, will erect a plant for the manufacture of metal lighters and specialties. Charles P. Landon and Jesse J. Foster are interested.

The Schaake Machine Works, New Westminster, B. C., is planning the erection of a new plant.

The Canadian Car & Foundry Co., Vancouver, B. C., is planning the erection of a large factory, at Port Mann, B. C. The estimated cost is $1,500,000. W. W. Butler is vice-president.

NEW INCORPORATIONS

METAL WORKING

The following companies have been incorporated to manufacture:

The Coal Construction Co., Kittery, Maine; coal and briquetting machinery. Capital, $50,000. Incorporated by the Corporation Trust Co., New York, N. Y.

The Standard Steel Shelving Co., Boston, Mass.; office fixtures. Capital, $25,000. Incorporators, Ernest L. Brown and Frederick W. Mowatt, both of Lynn, Mass.

The Max Bed Spring Co., Springfield, Mass.; bed springs. Capital, $5000. Incorporators: Louis Ratner, Meyer Fox and Augusta Fox.

The Ulmer Park Machine Works, Brooklyn, N. Y.; machinery. Capital, $5000. Incorporators, Carl W. Lawson, 1153 Fifty-first St.; Frederick W. Breisitz, 538 Fiftieth St., and Alfred Johnson, 5 Bay Thirty-eighth St., Brooklyn, N. Y.

The Keeton Engineering Co., Boro. Manhattan, N. Y.; motor vehicles and machinery. Capital, $2000. Incorporators, George B. Merriam, 142 West Twenty-fourth St.; Louis W. Wallner, 43 Cedar St., and Warren D. Grand, 80 Broadway, New York, N. Y.

The Composite Metal Lath Co., Boro. Manhattan, N. Y.; metal lath. Capital, $500,000. Incorporators, Joseph L. Young, 209 Adelphi St., Brooklyn, N. Y.; Gus W. Sokey, 2 Rector St., and Anna G. McConnell, 410 East 141st St., New York, N. Y.

The Maloney Electric Co., Manhattan, N. Y.; electric supplies. Capital, $700,000. Incorporators, I. J. Well, E. Blumenthal and J. H. Muller, New York, N. Y.

The American Industrial Gas Co., Manhattan, N. Y.; gas machinery. Capital, $100,000. Incorporators, M. Tahl, Brooklyn, and N. R. Lindheim and W. Abramson, New York, N. Y.

The Parlor Moving Picture Machine Co., Manhattan, N. Y.; motion picture machines. Capital, $25,000. Incorporators, Thomas F. Andrews, 51 Chambers St.; John J. Dugan, 1547 Broadway, and William V. Hart, 1253 Third Ave., New York, N. Y.

The New York Faucet Co., Boro. Manhattan, N. Y.; plumbing supplies. Capital, $100,000. Incorporators: Robert J. Horner, 61 West 23rd St., and Joseph G. F. Squires, 1125 Lexington Ave., New York, N. Y., and Charles Halcomb, Bridgeport, Conn.

The Ball Bearing Novelty Co., Boro. Manhattan, N. Y.; ball-bearing and mechanical devices. Capital, $6000. Incorporators: Alexander Greenberg, 874 Longwood Ave., Bronx, N. Y.; Alfred Pionier, 35 West 116th St., and Jacob Solomon, 60 Montgomery St., New York, N. Y.

D. Haberman & Co., Boro. Manhattan, N. Y.; structural and ornamental iron. Capital, $2000. Incorporators: Daniel Haberman and Annie Haberman, 1516 Charloth St., Bronx, N. Y., and Wolf Siegel, 358 Chester St., Brooklyn, N. Y.

Estate of J. W. Stirrup, Inc., Boro. Manhattan, N. Y.; tin ware. Capital, $50,000. Incorporators: Charles A. Stirrup, Frank A. Stirrup, 259 Front St., New York, N. Y., and Mary H. Stirrup, St. George Hotel, Brooklyn, N. Y.

The Edwin R. Smith Mfg. Co., Boro. Manhattan, N. Y.; draftsman's instruments and scientific instruments. Capital, $50,000. Incorporators: Edwin A. Smith, 65 East 11th St., New York, N. Y.; Morris Lazar, 724 Beck St., Bronx, N. Y., and Arthur Caddell, Paris, Tex.

The Goldberg-Davidson Co., Boro. Manhattan, N. Y.; buttons, metal goods and novelties. Capital, $2000. Incorporators: Max Davidson, 653 Lenox Ave., Martin Goldberg, 30 West 111th St., and A. R. Mendoza, 104 West 139th St., New York, N. Y.

The Merritt Street Sweeping Machine Co., Boro. Manhattan, N. Y.; street-sweeping machinery. Capital, $50,000. Incorporators: Benjamin V. Merritt and Anna V. Merritt, 361 East 188th St., New York, N. Y., and H. E. Theis, Crescent Theater, Mt. Vernon, N. Y.

The Frontier Brass Foundry, Inc., Niagara Falls, N. Y.; brass foundry. Capital, $25,000. Incorporators, John Lebherz, Robert Phipps and George W. Knox, Niagara Falls, N. Y.

The Samuel M. Langston Co., 104 Market St., Camden, N. J.; machinery for paper working and paper cutting. Capital, $125,000. Incorporators: S. M. Langston, Haddon Heights, N. J.; W. A. Squier, Wenonah, N. J., and Charles F. Langston, Camden, N. J.

The Tin Decorating Co. of Baltimore, 110 First St., Jersey City, N. J.; rolling, galvanizing and printing upon metals. Capital, $2,000,000. Incorporators: D. H. Haynes, V. E. Hansen and Charles B. Goldsborough, all of 110 First St., Jersey City.

The Universal Shear & Novelty Co., 10 Hobston St., Newark, N. J.; novelties of iron, steel, brass, gold, silver and nickel. Capital, $25,00. Incorporators: William F. Clark, 151 Fairmont Ave., Joseph J. Smith, 49 Littleton Ave., and William Lott, 35 Littleton Ave., all of Newark, N. J.

The Newark Carburetor Co., 810 Broad St., Newark, N. J.; machinists and metal workers. Capital, $20,000. Incorporators: J. H. Markey, Bloomfield, N. J.; D. B. Mulcahy and Alexander C. Orr, Newark, N. J.

The American Fire Proof Door Co., 324 Market St., Newark, N. J.; fireproof doors, casings, panels and vaults. Capital, $400,000. Incorporators: George W. Cross, A. W. Morton and Charles L. Steuerwald.

The Nagle Re Blade Knife Co., 41 South Sixth St., Newark, N. J.; cutlery. Capital, $500,000. Incorporators: George H. Nagle, Carl H. White and William A. Yerzley.

The James Metcalf Foundry Co., Newark, N. J.; foundry and machine shop. Capital, $50,000. Incorporators: James Metcalf, 177 Clinton Pl., Newark, N. J.; John Thomson, 268 Highland Ave., Kearney, N. J., and Andrew Hammond, 796 S. Orange Ave., Newark, N. J.

The Pittsburg Sheet & Tinplate Co., Morgantown, W. Va. Capital, $1,000,000. Incorporators, Harry T. Duke, Philadelphia, Penn.; George G. Sturgiss, Morgantown, W. Va., and Lakin C. Taylor, Cambridge, Ohio.

The Ragsdale Rotary Engine Co., Jackson, Miss.; rotary engines. Capital, $50,000. W. A. Ragsdale, Jackson, Miss.

The American Delinting Co., McRaven, Miss.; cotton seed delinting machinery. Capital, $50,000. William A. Pollack, Pascagoula, Miss.

The Dan Shea Boiler Works, Memphis, Tenn.; boilers. Capital, $20,000. Incorporators, Edward T. Shea, Dan Shea, Jr., and T. R. McCullough.

The Cleveland Worm & Gear Co., Cleveland, Ohio; machinery and parts. Capital, $100,000. Incorporators, Frank M. Gregg, A. T. Hills and G. R. Roller.

The Mirroscope Co., Cleveland, Ohio; stereopticon machinery. Capital, $10,000. Incorporators, P. A. White, O. O. Vrooman and H. L. Parmenter.

The Automatic Machinery Mfg. & Sales Co., Indianapolis, Ind.; machinery for

bottling works. Capital, 300,000. Incorporators, R. G. Hemingray, I. D. Lambertson and J. A. Hook.

The Ideal Flashing Co., Chicago, Ill.; flashings. Capital, $5000. Incorporators: George L. Wilkinson, Carl A. Richmond and Henry A. Parks.

The Utopian Power Co., Chicago, Ill.; engines and machinery. Capital, $40,000. Incorporators: Robert E. Heap, Jonathan E. Price and Lucy R. Heap.

The American Safety Valve Co., Chicago, Ill.; electrical and other machinery. Capital, $1,250,000. Incorporated by Joel L. Isaacs, 3814 Ellis Ave., Chicago.

Judd Electric Washing Co., Chicago, Ill.; machinery. Capital, $2500. Incorporators: Alfred L. Lindsay, James P. Gascoigne and John G. Heumann.

The E. J. Claffey Co., Chicago, Ill.; manufacturing and installing heating, plumbing and gas-fitting systems. Capital, $2500. Incorporators: E. J. Claffey, C. F. Claffey and T. R. Claffey, Jr.

The Zilio Sales Co. of Illinois, Chicago, Ill.; motor vehicles and accessories. Capital, $30,000. Incorporators: Jesse O. Barker, F. A. Alexander and F. E. Alexander, Jr.

The Economy Electric Sign Co., Chicago, Ill.; electric signs. Capital, $50,000. Incorporators: W. B. Cooley, Roderick W. McKinnon and J. C. Cooley.

General Manufacturing

NEW ENGLAND STATES

The city of Brunswick, Maine, will build a new reservoir, with a capacity of 3,000,000 gal.

The engine and boiler rooms of the Beal & Walker Lumber Mill, at Pittsfield, Maine, were damaged by fire, on May 15. The estimated loss is $5000.

The barrel-heading mill of A. F. Sanborn & Sons, Steep Falls, Maine, was totally destroyed by fire. Loss, $7000.

The Bradford Durfee Textile School, of Fall River, Mass., will build a new power house.

Bids are being received for the construction of a four-story and basement factory, 87x111 ft., for the Taylor-Burt Paper Co., Holyoke, Mass. Samuel M. Green, Inc., Springfield, Mass., is the architect.

The Lowell Waste Co., Lowell, Mass., will construct a new building as an addition to its plant. The structure will be two stories high, 40x75 ft., of brick.

The Mansfield Bleachery, Mansfield, Mass., is to build an addition, 40x60 ft., which will enable it to double its output.

The polishing mill of the Milne & Chalmers Granite Co., Inc., Quincy, Mass., was damaged by fire, May 20. Loss to machinery, $15,000.

The machine shop of the Lee Lime Co., Springfield, Mass., was destroyed by fire, May 19. The loss is estimated at $1500, and consists mainly of damage to steam engine, drills and tools, and the destruction of the roof of the building.

The factory of the Chandler Oil Cloth & Buckram Works, Taunton, Mass., was damaged by fire, May 18. Loss, $28,000.

The Home Furniture Co., Worcester, Mass., recently incorporated with $50,000 capital, is about to install machinery in the Westboro mills, at Westboro, Mass., where it will manufacture upholstery material of all kinds. F. H. Nickerson, of Worcester, is president.

The Birdseye Somers Co., Bridgeport, Conn., manufacturer of corsets, will erect a new plant, on Barnum Ave.

Work has been started on rebuilding the plant of the Royal Equipment Co., Bridgeport, Conn., which was damaged by fire.

The Hartford Electric Light Co., Hartford, Conn., will erect a two-story substation, 32x33 ft.

The Versailles Fiber Mill Co. has been organized to manufacture absorbent cotton and medicated bandages in the Versailles Mills, Hartford, Conn., and will replace present old machinery with new.

The Architectural Works Co., New Haven, Conn., manufacturers of architectural stone, plaster caps, etc., will erect a two-story factory, on Porter St.

The Interstate Rubber Co., manufacturer of raincoats, whose plant at South Norwalk, Conn., was destroyed by fire, has decided not to rebuild and will remove the business to Springvale, Conn., where it will erect a plant.

Arrangements are being made for the erection of a new factory building by B. N. Beard, at Shelton, Conn. When completed it will be occupied by a concern manufacturing baskets. The building will be 40x90 ft., two stories high, of brick.

The Cooper Oven Thermometer Co., Terryville, Conn., manufacturer of oven thermometers, will erect a new two-story factory, 34x50 ft.

MIDDLE ATLANTIC STATES

The Chalmers Knitting Co., Amsterdam, N. Y., has purchased a site on the south side of the Mohawk River, which has a frontage of about 300 ft. and extends back 360 ft., and will construct a new plant.

W. Herbert Perry, Amsterdam, N. Y., has filed plans for a four-story addition to his manufacturing establishment on Cedar St. John D. Lasher is the architect.

The contract for the construction of a five-story and basement addition, 100x60 ft., to the factory of the Ansco Co., manufacturer of photographers' supplies, Binghamton, N. Y., has been awarded. The estimated cost is $200,000.

The East Pembroke Canning Co., East Pembroke, N. Y., will erect a new canning factory at that place.

The Mohawk Silk Fabric Co., Fultonville, N. Y., has secured plans from H. W. Grimes, architect, Amsterdam, N. Y., for remodeling its 80x35-ft. mill, which was gutted, several months ago, by fire, and for an extension, 50x52 ft., two stories high.

The Howe Creamery Co. has been recently incorporated at Jordon, N. Y., with a capital of $25,000, and will soon build a refrigerating plant and canning factory at that place.

Henry Schnapper, Herman J. Nemman and William T. Collins, of Kinderhook, N. Y., are the incorporators of the Kinderhook Knitting Co., which will establish a plant for the manufacture of knitted goods.

Charles H. Watson, G. A. S. Schrader and C. N. Pitcher have purchased the old Corrington air-brake plant in Matteawan, N. Y., and will convert it into a factory for the manufacture of wool and straw hats.

The Thomas Hide & Leather Co., Middleville, N. Y., is contemplating the construction of additions to its plant. The estimated cost is $100,000. Walter J. Frank, Clarendon Bldg., Utica, N. Y., is the architect.

The second floor of the loft building at 153 Mercer St., New York, occupied by G. Kroff & Co., manufacturers of hats, was damaged by fire, May 17. Loss, $2000.

The third floor of the loft building at 112 Franklin St., New York, occupied by N. Katzin, manufacturer of blouses, was damaged by fire, May 17. Loss, $2000.

The fourth floor of the loft building at 101 Bleecker St., New York, occupied by J. Roth, manufacturer of dresses, was damaged by fire, May 17. Loss, $10,000.

The third floor of the factory building at 313 Grand St., New York, occupied by I. Miller, manufacturer of underwear, was damaged by fire, May 17. Loss, $1500.

The Niagara Bag & Paper Co. has had plans prepared for the construction of an addition to its plant on Robinson St., North Tonawanda, N. Y.

The cider mill and bran distillery of the P. Garlock Co., at Phelps, N. Y., was destroyed by fire, May 16. Loss, $7000; insurance, $3000.

The Phoenix Horseshoe Co., Poughkeepsie, N. Y., intends building a plant on its property to manufacture its own kegs.

The Rochester Asbestos Shingle & Fire Proofing Co., Rochester, N. Y., recently incorporated with a capital of $150,000, has had plans prepared for a three-story factory, 80x132 ft., to be erected at Gates, N. Y. It will be fireproof and of brick. Rees & Ade are the architects.

The mill of the E. I. du Pont de Nemours Powder Co., at Schaghticoke, N. Y., was wrecked by lightning, May 21. Loss, $20,000.

Hain Bros., proprietors of the Wernersville Hosiery Mills, Wernersville, Penn., are having plans prepared for the erection of a new plant, which will be located on West Market St.

The Wilson Cotton Mills, Wilson, N. Y., will build an addition to its factory and install new machinery. The estimated cost is $25,000.

The contract for the construction of a three-story factory on Fifth and Erie Sts., Camden, N. J., for Kind & Landesmann, manufacturers of gelatin, has been awarded.

The factory of the Structural Supply Co., manufacturer of mantels, 109 Fifth St., Jersey City, N. J., was damaged by fire, May 21. Loss, $5000.

Plans are being prepared by the Consolidated Color & Chemical Co., Brown and Lister Aves., Newark, N. J., for the erection of an addition to its plant. The structure will be 50x107 ft.

The Public Service Gas Co., Newark, N. J., will erect a three-story brick workshop, 78x30 ft., with an extension, 60x29 ft. The estimated cost is $15,000.

The lumber plant and mill of Hunter F. Bright, Ashland, Penn., were burned, May 18. Loss, $40,000, with no insurance.

The Easton Finishing Co., manufacturer of cotton goods, has purchased land in Easton, Penn., and will soon begin the construction of a plant.

The cooperage shop of James McCartney, at 930 North Fifty-first St., Philadelphia, Penn., was destroyed by fire, May 20. Loss, $7000.

Swift & Co., meat packers, Chicago, Ill., will build a smoke house in Baltimore, Md.

SOUTHERN STATES

The Charleston Dunbar Traction Co., Charleston, W. Va., will erect a one-story power plant, 64x122 ft., and car barn, to cost $8000. J. L. Montgomery is the architect.

The main shed at the Charlotte branch of the Virginia-Carolina Chemical Co., Charlotte, N. C., was destroyed by fire, May 20. Loss, $80,000, practically covered by insurance.

Charles W. Johnson, Charlotte, N. C., has purchased a site and is having plans prepared for his new cotton factory. Noted Apr. 18.

The National Wood Products Co., Wilmington, N. C., recently incorporated with a capital of $1,500,000, is planning to construct a plant.

The Wilson Cotton Mills, Wilson, N. C., will build an addition and will install new machinery, costing about $25,000.

A. F. Messick and associates contemplate erecting a cannery at Winston-Salem, N. C.

W. W. Hess, Philadelphia, Penn., will erect a gas plant, to cost $100,000, at Anderson, S. C.

The Condon Baking Co., Charleston, S. C., is having plans prepared for a bakery.

The Athens Gas, Light & Fuel Co., Athens, Ga., will expend $27,000 for improvements to its plant.

The factory of the Macon Cabinet Works, owned by Carl Dohn, Macon, Ga., was destroyed by fire, May 18. Loss, $20,000.

The city of Macon, Ga., will spend $200,000 for a power plant to supply power to the car system.

The Consumers' Ice Co., Tampa, Fla., is having plans prepared for a three-story cold-storage plant, 105x105 ft., to cost $50,000.

The plant of the Hygiene Ice Co. on the A., B. & A. tracks, Birmingham, Ala., is nearing completion.

The Naval Stores Co. will build a plant to cost $150,000, at Bay Minette, Ala. Machinery required will include six large boilers and equipment for electric lighting.

The mill of the Perido Shingle Co., at Bay Minette, Ala., was destroyed by fire, May 15.

J. A. Williamson and F. G. Thomas will equip a large canning plant, at Demopolis, Ala.

The Prattville Cotton Mills Co., Prattville, Ala., will add machinery costing about $50,000, and will erect a new warehouse.

The New Orleans Acid & Fertilizer Co., Gretna, La., will double the capacity of its sulphuric-acid plant.

Bids will be received about July 1 for the construction of a plant for the Mansfield Clay Products Co., Mansfield, La., which was recently incorporated with a capital of $100,000. The estimated cost of the buildings is $35,000. T. A. Snell is the president.

The Pilette Co., Ltd., Pilette, La., recently incorporated with a capital of $50,000, will construct a sugar refinery plant. J. O. Broussard is the president.

The Bayou Cane Land Co., St. Elmo, La., will erect two canneries.

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The Grief Bros. Cooperage Co., Cleveland, Ohio, maker of barrels and kegs, will add new machinery to its present plant.

The Bardons & Oliver Co., Cleveland, Ohio, manufacturer of turret lathes, has let the contract for the erection of a five-story reinforced-concrete factory, at the foot of West Ninth St.

The Niagara Laundry & Linen Supply Co., Cleveland, Ohio, will erect a one-story laundry, 60x80 ft. G. S. King, 319 Permanent Building, is the architect.

The Arnold Creamery Co., Cleveland, Ohio, will erect a two-story creamery, 50x90 ft. Tousley & Hieband are the architects.

The factory of the Cincinnati Panel Co., Eighth St., Cincinnati, Ohio, was destroyed by fire. Loss, about $25,000.

The Cincinnati Ice Co., Cincinnati, Ohio, has raised its capital to $1,320,000. A new ice-making plant will be built.

J. E. Addison Co. will establish a third plant for the manufacture of gloves and overalls at Cambridge, Ohio.

The Columbia Cement Shingle and Tile Co., a new corporation, will erect a two-story concrete factory building, 40x80 ft., on Columbia and Bonnell Aves., in Reading, Ohio.

The A. H. Jackson Co., Jackson, Ohio, will locate a branch factory, at Fremont, Ohio.

The Knabe Piano Co., Norwood, Ohio, which was destroyed by fire last winter is rebuilding its plant and will require new machinery.

Power-plant equipment will be bought by the Wilcoxton Water Co., of Twinsburg, Ohio.

The power plant of the Saltillo Coal Co., Zanesville, Ohio, was destroyed by fire, May 17. Loss, $15,000.

Pitkin & Brooks, of Chicago, Ill., will build a glass factory, at Valparaiso, Ind.

The Ann Arbor Abattoir Co., Ann Arbor, Mich., is having plans prepared for a two-story slaughter house, 75x62 ft. The estimated cost is $20,000. E. Slochtemyer, Lincoln Inn Court Building, Cincinnati, Ohio, is the architect.

The Diamond Match Co., Detroit, Mich., is erecting a large addition to its plant.

The Detroit City Gas Co., Detroit, Mich., is building an $8000 addition to its Station "A" plant.

The New England Pie Co., Detroit, Mich., is erecting a large addition to its bakery.

The Grand Laundry Co., Detroit, Mich., is building a $4800 addition to its plant, on Lafayette St.

The Wayne Soap Co., Detroit, Mich., manufacturer of soap, is erecting an addition to its factory, at 121 Hendricks Ave.

The New York Central Lines, N. Y., will spend $1,000,000 for the erection of a roundhouse, coal chutes and yard improvements at Detroit, Mich. A. H. Smith is the vice-president, New York, N. Y.

The School Board of Ford, Mich., is planning to install manual training in a new school just opened. Equipment will be needed.

The machine room of the Centralia Pump & Waterpower Co., at Grand Rapids, Wis., was burned, May 20. Loss, $80,000, partly covered by insurance.

Armour & Co., Chicago, Ill., are having plans prepared for a three-story concrete addition, 113x113 ft., to their grape-juice factory, at Mattawan, Mich.

A new grist mill is to be erected at Newberry, Mich., Luce County, for the manufacture of flour.

A grist mill is being erected in Ironwood Township, Gogebic County, Mich., for the producing of flour.

The Michigan Cold Storage Co., 515 North Water St., Saginaw, Mich., is having plans prepared for a one-story boiler and engine house, 40x64 ft. Cowles & Mutcheller, Chase Building, are the architects. The estimated cost is $18,000. Jacob Stingel is manager.

The Crown Chemical Co., Grayling, Mich., will remove its plant to Sheboygan, Mich., for a larger factory.

Fire partly destroyed the buildings of the Cook Linoleum Co., 1444 Hawthorne Ave., Chicago, Ill. Loss, $5000.

The Garden City Brewery, Chicago, Ill., will erect a three-story boiler house, 22x46 ft., to cost $6500.

The Schultze Baking Co., Chicago, Ill., will erect a three-story bakery, at Seventy-fifth St. and Yale Ave.

The Eisendrath-Schwab Co. will build a one-story brick factory, to be used as a tannery, at 1310 North Halsted St., Chicago, Ill. New machinery will be used.

The cold-storage plant of the Consumers' Ice Co., West Thirty-fifth and Butler Sts., Chicago, Ill., was destroyed by fire, May 17. Loss, $250,000, principally on machinery.

Jerome Sorce, 164 Chicago Ave., Chicago, Ill., will build a one-story brick factory, at 5178 Norwood Park Ave., to be used as an oil refinery and bottling works. W. D. Man is the architect.

The McDonald Engineering Co. is the architect for a seven-story concrete grain elevator to be built by the Acme Malting Co., Chicago, Ill. The estimated cost is $100,000.

The Standard Desiccating & Fertilizer Co., Chicago, Ill., has purchased a site at Elmwood Place, Cincinnati, Ohio, and will erect a large fertilizer factory.

The Strand Bros., Monmouth, Ill., will erect a two-story bakery, 72x90 ft., to cost $15,000.

Charles Winkler, 1318 Seventh Ave., Moline, Ill., will erect a three-story laundry.

The Lorch Laundry Co., Peoria, Ill., will erect a two-story laundry, to cost $25,000.

The D. S. Long Tailoring Co., Peoria, Ill., is installing new machinery and equipment.

The Allaire Woodward Co., Peoria, Ill., will erect a large four-story brick addition, 110x30 ft., at Main and Water Sts.

The Allare-Woodwork Chemical Co., Peoria, Ill., is building a four-story addition to its plant, to cost $10,000.

The B. Z. B. Knitting Co., Rockford, Ill., will erect a ten-story factory building, 56x156 ft., at a cost of $100,000.

The Roddis Lumber & Veneer Co., Marshfield, Wis., will erect an addition, 48x60 ft., to its plant.

The egg-case factory of Keller & Martin, at Prairie du Chien, Wis., was damaged by fire, May 21. Loss, $8750, covered by insurance.

The Dunphy Mfg. Co., Racine, Wis., manufacturer of screen doors and sashes, will erect a new factory, on North Erie St.

The Optenberg Iron Works, Sheboygan, Wis., is making improvements to its present plant. A new 125-hp. boiler will be installed, also heating equipment, and an 80-ft. smokestack will be erected.

The Whitewater Condensed Milk Co., Whitewater, Wis., recently incorporated, is contemplating the erection of a plant at Whitewater. The estimated cost is $100,000. M. A. Fees is interested.

WEST OF THE MISSISSIPPI

The contract for the construction of a factory at Council Bluffs, Iowa, for the Positive Print Machine & Paper Co., Omaha, Neb., has been awarded. Noted May 16.

A special election will be held in Logan, Iowa, June 10, for the purpose of voting on the proposition of improving and extending the water system. The estimated cost is $20,000.

The C. G. Hardin Co., St. Paul, Minn., has purchased a site on Dale St., covering about 2½ blocks, and will construct a coal-storage yard, a coal elevator and a rescreening plant for handling the coal by machinery. About $40,000 will be expended.

The Halstead Milling & Elevator Co., Halstead, Kan., is planning the construction of a two-story concrete addition to its mill.

The city of Larned, Kan., has had preliminary plans prepared for the construction of extensions to its water system and for street lighting. The estimated cost of the improvements is $40,000.

The citizens of Coleridge, Neb., have voted bonds for $8500 for the extension of the water-works system and for the erection of a standpipe.

The city of Eustice, Neb., has voted bonds for $17,000 for the construction of a water-works system.

The factory of the Home Cleaning Plant, Fremont, Neb., was damaged by fire, May 16. Loss covered by insurance.

The grain elevator of Rhodes & Mayer, at Howe, Neb., was destroyed by fire, May 15. Loss, $10,000, covered by insurance.

Bids will be received by D. K. Barr, village clerk, Louisville, Neb., until June 4, for the construction of a water-works system. The estimated cost is $15,000.

The Rapid City Gypsum, Lime & Portland Cement Co., Rapid City, S. D., is planning the erection of a factory,

30x125 ft., with a capacity of about 5200 tons of gypsum. As soon as the gypsum plant is under way, a cement plant will be installed at a cost of about $200,000.

The Lewistown Commission Co., Lewistown, Mont., has had plans prepared for the construction of a cold-storage plant. The estimated cost is $10,000.

The contract for the construction of an ice plant at the State Penitentiary, Jefferson City, Mo., has been awarded. The estimated cost is $30,300.

The Enno Sander Mineral Water Co., St. Louis, Mo., will erect a two-story factory at Compton and Lucas Aves. The estimated cost is $14,000.

J. Calvin Hess, Fowlerton, Tex., is contemplating the establishment of a knitting mill, at Fowlerton, for the manufacture of hosiery and other knitted goods.

The city of Henrietta, Tex., is contemplating the installation of a new water-works system. The estimated cost is $18,000. R. C. Green is city secretary.

The Keton Baking Co., Waco, Tex., is planning to enlarge and improve its plant. F. Keton is president.

The gin of the Industrial Oil Co., at Whitney, Tex., was burned, May 15. Loss, $8000.

The contract has been awarded for the construction of a water-works plant, at Milliken, Colo. The estimated cost is $15,000. R. M. Benton is mayor.

WESTERN STATES

W. Wolph, Kansas City, Mo., and Hans Herlick, Phoenix, Ariz., are planning the erection of a steam bakery and cracker factory at Phoenix.

Fire destroyed the mill and warehouse of the Bridgeport Milling Co. and the warehouse of the Farmers' Union, at Bridgeport, Wash., May 20. Loss, $125,000.

The shingle mill plant of the Mowett Shingle Mill Co., Echo Lake, Wash., was destroyed by fire with a loss of $10,000.

Depew Bros. will establish a shingle mill at Elma, Wash., on the site of the old brick plant.

The city of Everett, Wash., is planning the installation of a new municipal water-works system. The city council is in charge.

The mill of the Baring Shingle Mill Co., near Index, Wash., was destroyed by fire, with a loss of about $30,000.

The Hall Lumber Co., Mount Vernon, Wash., recently incorporated with a capital of $25,000, will take over the old J. W. Hall sawmill and enlarge and improve it. It will have a capacity of 75,000 ft. daily.

The Pine Box & Lumber Co., North Yakima, Wash., recently incorporated with a capital stock of $80,000, will build a plant for the manufacture of fruit boxes. It will be located in the timber district, near North Yakima.

The dry kiln of Mill No. 3 of the Case Shingle & Lumber Co., Raymond, Wash., was destroyed by fire, May 15. Loss, $9000, with no insurance.

The Idaho Portland Cement Co., Spokane, Wash., is contemplating the erection of a cement factory at Asotin, Wash. The estimated cost is $500,000.

The Canal Mfg. Co., Seattle, Wash., will increase the capacity of its plant by the addition of a tenoner, boring machine, sander and clamps. The company makes a specialty of manufacturing window screens. W. B. Staples is interested.

The Spokane Woodworking Co., Spokane, Wash., will enlarge its plant for manufacturing showcases, store fixtures and interior finish. Herman Person, John Carlson and Knute K. Engdahl are the owners.

The contract has been awarded for the construction of a factory at Sumner, Wash., for the Fleischmann Yeast Co., Cincinnati, Ohio. The estimated cost is $150,000. John Graham, Lyon Bldg., Seattle, Wash., is the architect. Noted Apr. 25.

The Tacoma Fir Door Co., East Q St. and Cleveland Way, Tacoma, Wash., will erect a boiler and engine-house addition to its plant.

The city of Cleone, Ore., will soon hold an election to bond the city for $10,000 for the installation of a new water-works system. The city council is in charge.

The citizens of Hood River, Ore., have voted bonds for $90,000 for the construction of a municipal water-works system.

The H. J. Heinz Co., Pittsburgh, Penn., has acquired a site at Corning, Calif., and will erect a large olive-packing plant.

The Caliente Lime & Marble Co., Fresno, Calif., has been incorporated with a capital of $75,000 by Fred J. Stone, N. P. Justy and A. A. Chevalier. The company will erect a plant at Fresno for the manufacture of lime products and marble goods.

L. E. Rogers and associates, of Los Angeles, Calif., are planning the erection of an electric-light plant at Beaumont, Calif. A steam-laundry plant will be operated in connection with the electric plant.

The Pacific Sewer Pipe Co., Los Angeles, Calif., has acquired a site covering 32 acres, at Los Nietos, Calif., and will erect a plant for the manufacture of tile, sewer pipe and other clay products.

Cline & Poole, Placentia, Calif., have purchased a site at Placentia, and will erect a cement pipe and tile factory.

J. T. Riatt, Artesia, Calif., has purchased a site in Porterville, Calif., and will erect a large creamery plant. About $30,000 will be expended.

The American Distilling Co., Sacramento, Calif., has acquired a site at Hood, a new townsite near Sacramento, and will erect a plant for the manufacture of industrial alcohol. The plant will cost about $100,000. The distillery will have a capacity of 1000 gallons daily.

The Bear Mountain Orange Co., San Bernardino, Calif., will install several large pumping plants on its property in Kern County.

The Pacific Gas & Electric Co., San Francisco, Calif., will soon begin the erection of a large hydro-electric power plant on the Bear River.

The McRoskey Mattress Co., San Francisco, Calif., has acquired a site at Sunnyvale, Calif., and will erect a new mattress factory.

The California Fruit Canners' Assn., Santa Rosa, Calif., will increase the capacity of and install new machinery in its plant at Santa Rosa.

The Southern California Edison Co., Los Angeles, Calif., is preparing to furnish the city of Van Nuys, near Los Angeles, with electricity. A substation will be erected.

CANADA

The Alaska Bedding Co., Winnipeg, Man., will erect a branch factory, at Calgary, Alta.

The Chilliwack Creamery Association, Chilliwack, B. C., is planning the erection of a refrigerating plant, having a capacity of 24 tons daily.

George E. Knight, Edmonds, B. C., is planning the erection of a large dairy and creamery plant, at Edmonds.

The Moose Jaw Milling Co., Saskatchewan, B. C., whose flour milling plant was recently destroyed by fire, will build a new plant, at Port Mann, B. C.

The Woodworkers, Ltd., Victoria, B. C., will build an addition to their sash and door factory, on Douglas St., Victoria.

The sawmill of the Seymour Lumber Co., Vancouver, B. C., was destroyed by fire, May 14. Loss, $75,000.

The plant of the Diamond Glass Co., Hamilton, Ont., was destroyed by fire, May 18. Loss, $25,000.

The sawmill of the Carney Lumber Co., Owen Sound, Ont., was completely destroyed by fire. Loss, $150,000. The mills were owned by Fred and Frank Carney, Marinette, Wis.

The Interlake Tissue Mills, St. Catherines, Ont., has awarded the contract for the construction of its two-story factory, 100x208 ft.

The Cerveceria de Monterey Co., Botica San Luis Building, Monterey, Mex., will soon erect a large brewery plant, at Monterey. A cold-storage plant will be built in connection. Dr. Ramon Trevino and John Forseck are interested.

NEW INCORPORATIONS

GENERAL MANUFACTURING

The following companies have been incorporated to manufacture:

The American Life Saving Garment Co., Boston, Mass.; life-saving apparel. Capital, $25,000. Incorporators: John B. McSwain and John R. Batchelder.

The Fairmont Creamery Co. of New York, Buffalo, N. Y.; dairy products. Capital, $50,000. Incorporators: Lamont Brace, Buffalo, and George W. Summer and Joseph H. Rushton, Omaha, N. Y.

The Novelty Games Co., Boro. Manhattan, N. Y.; games and novelties. Capital, $10,000. Incorporators: Francis H. Medhurst, Joseph H. Tucker and Eleanor Medhurst, 114 East 18th St., New York, N. Y.

The Un-X-L-D Paper Box Co., Boro. Manhattan, N. Y.; paper boxes. Capital, $10,000. Incorporators: Samuel L. Green, 822 Beck St., Harry M. Levy, 107 Clinton St., and Samuel J. Joseph, 837 Beck St., New York, N. Y.

The W. & G. Film Co., Boro. Manhattan, N. Y.; motion-picture film. Capital, $10,000. Incorporators: Arthur B. Graham, 310 West 97th St., Howard E. Brown, Summit Ave. and 161st St., and Robert M. Simpson, 474 Central Park West, all of New York, N. Y.

The Lenox Silk Works, Boro. Manhattan, N. Y.; silk and wool textiles. Capital, $10,000. Incorporators: Harry B. Hull and Anna B. Hull, 170th St. and Fort Washington Ave., New York, N. Y., and Walter B. Griffen, Mahwah, N. J.

The Greenfield Shoe Co., Boro. Manhattan, N. Y.; shoes. Capital, $3500. Incorporators: Regina Greenfield and Phil Greenfield, 779 8th Ave., New York, N. Y., and David Schwartz, 527 Broadway, Brooklyn, N. Y.

The Onyx Mills Co., Manhattan, N. Y.; woolen and worsted goods. Capital, $10,000. Incorporators: Maurice Goldman, 849 Glenmore Ave., Brooklyn, N. Y.; Nathan Cohen, 1642 Madison Ave., and Joseph Abramson, 23 West 111th St., New York, N. Y.

The McCahill Soda Fountain Co., Boro. Manhattan, N. Y.; soda fountains. Capital, $50,000. Incorporators: William J. McCahill and Charles F. McCahill, 319 East 53rd St., and Theodore B. Hoy, 150 Nassau St., all of New York, N. Y.

The Fancy & Plain Paper Box Co., Boro. Manhattan, N. Y.; paper boxes. Capital, $5000. Incorporators: Tanchem Bandolik, 433 Wyonne St., Brooklyn, N. Y.; Costas G. Papaconstantinou, 65 Forsyth St., and E. A. Eichner, 6 Park Row, New York, N. Y.

The Virginia Stave Co., Manhattan, N. Y.; lumber. Capital, $25,000. Incorporators, E. G. Chamberlin, W. E. Mitchell, Montclair, N. J., and H. D. Nims, Bronxville, N. Y.

The Malkan Furniture Co., Manhattan, N. Y.; furniture. Capital, $5000. Incorporators, Charles Malkan, 216 West One Hundred and Forty-third St., and Joseph Malkan and Jacob Malkan, 607 Ninth Ave., New York, N. Y.

The Empire Furniture Co., Manhattan, N. Y.; furniture. Capital, $6000. Incorporators, Jacob Harrison and Fanny Harrison, 34 Cedar St., and Isidore Meislich, 387 South Fourth St., Brooklyn.

The Erstling Bros. Knitting Mills, Manhattan, N. Y.; knit goods. Capital, $10,000. Incorporators, Louis Rothschild, 4 East Sixtieth St.; Max Erstling, 549 West One Hundred and Forty-fifth St., and Joseph R. Erstling, 318 West One Hundred and Thirteenth St., all of New York, N. Y.

The East Windsor Hill Brick Co., New Windsor, N. Y.; bricks. Capital, $36,000. Incorporators: Joseph A. Lahey, Hartford, Conn.; Annie A. Lahey, Newburg, N. Y., and Nora M. O'Meara, Kingston, N. Y.

The Niagara Falls Linen Co., Niagara Falls, N. Y.; textiles. Capital, $150,000. Incorporators: George R. Shepard, 609 Jefferson Ave., Adin B. Chase, 531 6th St., and Alan H. G. Hardwiche, 269 3rd St., Niagara Falls, N. Y.

The Rochester Asbestos Shingle & Fire Proofing Co., Rochester, N. Y.; asbestos shingles and building supplies. Capital, $150,000. Incorporators: C. H. Briggs, Granite Bldg., William H. Karnes, Granite Bldg., and W. G. Gilbert, Eggleston Hotel, all of Rochester, N. Y.

The Genesee Textile Co., Rochester, N. Y.; textiles. Capital, $35,000. Incorporators, J. Sawyer Fitch, Hugh Satterlee and H. D. Van Duser, Rochester, N. Y.

The Ocean Pearl Button Works, 213 26th St., Guttenberg, N. J.; pearl buttons and products. Capital, $2100. Incorporators: F. Jelinek, Thomas Uranek and William Prochaska.

The Lobsitz Mills, Harrison St., Nutley, N. J.; silk and other textile fabrics. Capital, $250,000. Incorporators: William F. Pippey, George W. Levett and H. L. Basch, all of New York, N. Y.

Stark & Faussett, 227 East State St., Trenton, N. J.; mantles, tile and tile works. Capital, $50,000. Incorporators: Charles W. Stark, George U. Noorhead and W. F. Smith.

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The City Ice Delivery Co., Cleveland, Ohio, will build a large addition to its ice-making plant.

The Grief Bros. Cooperage Co., Cleveland, Ohio, maker of barrels and kegs, will add new machinery to its present plant.

The Bardons & Oliver Co., Cleveland, Ohio, manufacturer of turret lathes, has let the contract for the erection of a five-story reinforced-concrete factory, at the foot of West Ninth St.

The Niagara Laundry & Linen Supply Co., Cleveland, Ohio, will erect a one-story laundry, 60x80 ft. G. S. King, 319 Permanent Building, is the architect.

The Arnold Creamery Co., Cleveland, Ohio, will erect a two-story creamery, 50x90 ft. Tousley & Hieband are the architects.

The factory of the Cincinnati Panel Co., Eighth St., Cincinnati, Ohio, was destroyed by fire. Loss, about $25,000.

The Cincinnati Ice Co., Cincinnati, Ohio, has raised its capital to $1,320,000. A new ice-making plant will be built.

J. E. Addison Co. will establish a third plant for the manufacture of gloves and overalls at Cambridge, Ohio.

The Columbia Cement Shingle and Tile Co., a new corporation, will erect a two-story concrete factory building, 40x80 ft., on Columbia and Bonnell Aves., in Reading, Ohio.

The A. H. Jackson Co., Jackson, Ohio, will locate a branch factory, at Fremont, Ohio.

The Knabe Piano Co., Norwood, Ohio, which was destroyed by fire last winter is rebuilding its plant and will require new machinery.

Power-plant equipment will be bought by the Wilcoxton Water Co., of Twinsburg, Ohio.

The power plant of the Saltillo Coal Co., Zanesville, Ohio, was destroyed by fire, May 17. Loss, $15,000.

Pitkin & Brooks, of Chicago, Ill., will build a glass factory, at Valparaiso, Ind.

The Ann Arbor Abattoir Co., Ann Arbor, Mich., is having plans prepared for a two-story slaughter house, 75x62 ft. The estimated cost is $20,000. E. Slochtemyer, Lincoln Inn Court Building, Cincinnati, Ohio, is the architect.

The Diamond Match Co., Detroit, Mich., is erecting a large addition to its plant.

The Detroit City Gas Co., Detroit, Mich., is building an $8000 addition to its Station "A" plant.

The New England Pie Co., Detroit, Mich., is erecting a large addition to its bakery.

The Grand Laundry Co., Detroit, Mich., is building a $4800 addition to its plant, on Lafayette St.

The Wayne Soap Co., Detroit, Mich., manufacturer of soap, is erecting an addition to its factory, at 121 Hendricks Ave.

The New York Central Lines, N. Y., will spend $1,000,000 for the erection of a roundhouse, coal chutes and yard improvements at Detroit, Mich. A. H. Smith is the vice-president, New York, N. Y.

The School Board of Ford, Mich., is planning to install manual training in a new school just opened. Equipment will be needed.

The machine room of the Centralia Pump & Waterpower Co., at Grand Rapids, Wis., was burned, May 20. Loss, $80,000, partly covered by insurance.

Armour & Co., Chicago, Ill., are having plans prepared for a three-story concrete addition, 113x113 ft., to their grape-juice factory, at Mattawan, Mich.

A new grist mill is to be erected at Newberry, Mich., Luce County, for the manufacture of flour.

A grist mill is being erected in Ironwood Township, Gogebic County, Mich., for the producing of flour.

The Michigan Cold Storage Co., 515 North Water St., Saginaw, Mich., is having plans prepared for a one-story boiler and engine house, 40x64 ft. Cowles & Mutcheller, Chase Building, are the architects. The estimated cost is $18,000. Jacob Stingel is manager.

The Crown Chemical Co., Grayling, Mich., will remove its plant to Sheboygan, Mich., for a larger factory.

Fire partly destroyed the buildings of the Cook Linoleum Co., 1444 Hawthorne Ave., Chicago, Ill. Loss, $5000.

The Garden City Brewery, Chicago, Ill., will erect a three-story boiler house, 22x46 ft., to cost $6500.

The Schultze Baking Co., Chicago, Ill., will erect a three-story bakery, at Seventy-fifth St. and Yale Ave.

The Eisendrath-Schwab Co. will build a one-story brick factory, to be used as a tannery, at 1310 North Halsted St., Chicago, Ill. New machinery will be used.

The cold-storage plant of the Consumers' Ice Co., West Thirty-fifth and Butler Sts., Chicago, Ill., was destroyed by fire, May 17. Loss, $250,000, principally on machinery.

Jerome Sorce, 164 Chicago Ave., Chicago, Ill., will build a one-story brick factory, at 5178 Norwood Park Ave., to be used as an oil refinery and bottling works. W. D. Man is the architect.

The McDonald Engineering Co. is the architect for a seven-story concrete grain elevator to be built by the Acme Malting Co., Chicago, Ill. The estimated cost is $100,000.

The Standard Desiccating & Fertilizer Co., Chicago, Ill., has purchased a site at Elmwood Place, Cincinnati, Ohio, and will erect a large fertilizer factory.

The Strand Bros., Monmouth, Ill., will erect a two-story bakery, 72x90 ft., to cost $15,000.

Charles Winkler, 1318 Seventh Ave., Moline, Ill., will erect a three-story laundry.

The Lorch Laundry Co., Peoria, Ill., will erect a two-story laundry, to cost $25,000.

The D. S. Long Tailoring Co., Peoria, Ill., is installing new machinery and equipment.

The Allaire Woodward Co., Peoria, Ill., will erect a large four-story brick addition, 110x30 ft., at Main and Water Sts.

The Allare-Woodwork Chemical Co., Peoria, Ill., is building a four-story addition to its plant, to cost $10,000.

The B. Z. B. Knitting Co., Rockford, Ill., will erect a ten-story factory building, 56x156 ft., at a cost of $100,000.

The Roddis Lumber & Veneer Co., Marshfield, Wis., will erect an addition, 48x60 ft., to its plant.

The egg-case factory of Keller & Martin, at Prairie du Chien, Wis., was damaged by fire, May 21. Loss, $8750, covered by insurance.

The Dunphy Mfg. Co., Racine, Wis., manufacturer of screen doors and sashes, will erect a new factory, on North Erie St.

The Optenberg Iron Works, Sheboygan, Wis., is making improvements to its present plant. A new 125-hp. boiler will be installed, also heating equipment, and an 80-ft. smokestack will be erected.

The Whitewater Condensed Milk Co., Whitewater, Wis., recently incorporated, is contemplating the erection of a plant at Whitewater. The estimated cost is $100,000. M. A. Fees is interested.

WEST OF THE MISSISSIPPI

The contract for the construction of a factory at Council Bluffs, Iowa, for the Positive Print Machine & Paper Co., Omaha, Neb., has been awarded. Noted May 16.

A special election will be held in Logan, Iowa, June 10, for the purpose of voting on the proposition of improving and extending the water system. The estimated cost is $20,000.

The C. G. Hardin Co., St. Paul, Minn., has purchased a site on Dale St., covering about 2½ blocks, and will construct a coal-storage yard, a coal elevator and a rescreening plant for handling the coal by machinery. About $40,000 will be expended.

The Halstead Milling & Elevator Co., Halstead, Kan., is planning the construction of a two-story concrete addition to its mill.

The city of Larned, Kan., has had preliminary plans prepared for the construction of extensions to its water system and for street lighting. The estimated cost of the improvements is $40,000.

The citizens of Coleridge, Neb., have voted bonds for $8500 for the extension of the water-works system and for the erection of a standpipe.

The city of Eustice, Neb., has voted bonds for $17,000 for the construction of a water-works system.

The factory of the Home Cleaning Plant, Fremont, Neb., was damaged by fire, May 16. Loss covered by insurance.

The grain elevator of Rhodes & Mayer, at Howe, Neb., was destroyed by fire, May 15. Loss, $10,000, covered by insurance.

Bids will be received by D. K. Barr, village clerk, Louisville, Neb., until June 4, for the construction of a water-works system. The estimated cost is $15,000.

The Rapid City Gypsum, Lime & Portland Cement Co., Rapid City, S. D., is planning the erection of a factory,

30x125 ft., with a capacity of about 5200 tons of gypsum. As soon as the gypsum plant is under way, a cement plant will be installed at a cost of about $200,000.

The Lewistown Commission Co., Lewistown, Mont., has had plans prepared for the construction of a cold-storage plant. The estimated cost is $10,000.

The contract for the construction of an ice plant at the State Penitentiary, Jefferson City, Mo., has been awarded. The estimated cost is $30,300.

The Enno Sander Mineral Water Co., St. Louis, Mo., will erect a two-story factory at Compton and Lucas Aves. The estimated cost is $14,000.

J. Calvin Hess, Fowlerton, Tex., is contemplating the establishment of a knitting mill, at Fowlerton, for the manufacture of hosiery and other knitted goods.

The city of Henrietta, Tex., is contemplating the installation of a new water-works system. The estimated cost is $18,000. R. C. Green is city secretary.

The Keton Baking Co., Waco, Tex., is planning to enlarge and improve its plant. F. Keton is president.

The gin of the Industrial Oil Co., at Whitney, Tex., was burned, May 15. Loss, $8000.

The contract has been awarded for the construction of a water-works plant, at Milliken, Colo. The estimated cost is $15,000. R. M. Benton is mayor.

WESTERN STATES

W. Wolph, Kansas City, Mo., and Hans Herlick, Phoenix, Ariz., are planning the erection of a steam bakery and cracker factory at Phoenix.

Fire destroyed the mill and warehouse of the Bridgeport Milling Co. and the warehouse of the Farmers' Union, at Bridgeport, Wash., May 20. Loss, $125,000.

The shingle mill plant of the Mowett Shingle Mill Co., Echo Lake, Wash., was destroyed by fire with a loss of $10,000.

Depew Bros. will establish a shingle mill at Elma, Wash., on the site of the old brick plant.

The city of Everett, Wash., is planning the installation of a new municipal water-works system. The city council is in charge.

The mill of the Baring Shingle Mill Co., near Index, Wash., was destroyed by fire, with a loss of about $30,000.

The Hall Lumber Co., Mount Vernon, Wash., recently incorporated with a capital of $25,000, will take over the old J. W. Hall sawmill and enlarge and improve it. It will have a capacity of 75,000 ft. daily.

The Pine Box & Lumber Co., North Yakima, Wash., recently incorporated with a capital stock of $80,000, will build a plant for the manufacture of fruit boxes. It will be located in the timber district, near North Yakima.

The dry kiln of Mill No. 3 of the Case Shingle & Lumber Co., Raymond, Wash., was destroyed by fire, May 15. Loss, $9000, with no insurance.

The Idaho Portland Cement Co., Spokane, Wash., is contemplating the erection of a cement factory at Asotin, Wash. The estimated cost is $500,000.

The Canal Mfg. Co., Seattle, Wash., will increase the capacity of its plant by the addition of a tenoner, boring machine, sander and clamps. The company makes a specialty of manufacturing window screens. W. B. Staples is interested.

The Spokane Woodworking Co., Spokane, Wash., will enlarge its plant for manufacturing showcases, store fixtures and interior finish. Herman Person, John Carlson and Knute K. Engdahl are the owners.

The contract has been awarded for the construction of a factory at Sumner, Wash., for the Fleischmann Yeast Co., Cincinnati, Ohio. The estimated cost is $150,000. John Graham, Lyon Bldg., Seattle, Wash., is the architect. Noted Apr. 25.

The Tacoma Fir Door Co., East Q St. and Cleveland Way, Tacoma, Wash., will erect a boiler and engine-house addition to its plant.

The city of Cleone, Ore., will soon hold an election to bond the city for $10,000 for the installation of a new water-works system. The city council is in charge.

The citizens of Hood River, Ore., have voted bonds for $90,000 for the construction of a municipal water-works system.

The H. J. Heinz Co., Pittsburgh, Penn., has acquired a site at Corning, Calif., and will erect a large olive-packing plant.

The Caliente Lime & Marble Co., Fresno, Calif., has been incorporated with a capital of $75,000 by Fred J. Stone, N. P. Justy and A. A. Chevalier. The company will erect a plant at Fresno for the manufacture of lime products and marble goods.

L. E. Rogers and associates, of Los Angeles, Calif., are planning the erection of an electric-light plant at Beaumont, Calif. A steam-laundry plant will be operated in connection with the electric plant.

The Pacific Sewer Pipe Co., Los Angeles, Calif., has acquired a site covering 32 acres, at Los Nietos, Calif., and will erect a plant for the manufacture of tile, sewer pipe and other clay products.

Cline & Poole, Placentia, Calif., have purchased a site at Placentia, and will erect a cement pipe and tile factory.

J. T. Riatt, Artesia, Calif., has purchased a site in Porterville, Calif., and will erect a large creamery plant. About $30,000 will be expended.

The American Distilling Co., Sacramento, Calif., has acquired a site at Hood, a new townsite near Sacramento, and will erect a plant for the manufacture of industrial alcohol. The plant will cost about $100,000. The distillery will have a capacity of 1000 gallons daily.

The Bear Mountain Orange Co., San Bernardino, Calif., will install several large pumping plants on its property in Kern County.

The Pacific Gas & Electric Co., San Francisco, Calif., will soon begin the erection of a large hydro-electric power plant on the Bear River.

The McRoskey Mattress Co., San Francisco, Calif., has acquired a site at Sunnyvale, Calif., and will erect a new mattress factory.

The California Fruit Canners' Assn., Santa Rosa, Calif., will increase the capacity of and install new machinery in its plant at Santa Rosa.

The Southern California Edison Co., Los Angeles, Calif., is preparing to furnish the city of Van Nuys, near Los Angeles, with electricity. A substation will be erected.

CANADA

The Alaska Bedding Co., Winnipeg, Man., will erect a branch factory, at Calgary, Alta.

The Chilliwack Creamery Association, Chilliwack, B. C., is planning the erection of a refrigerating plant, having a capacity of 24 tons daily.

George E. Knight, Edmonds, B. C., is planning the erection of a large dairy and creamery plant, at Edmonds.

The Moose Jaw Milling Co., Saskatchewan, B. C., whose flour milling plant was recently destroyed by fire, will build a new plant, at Port Mann, B. C.

The Woodworkers, Ltd., Victoria, B. C., will build an addition to their sash and door factory, on Douglas St., Victoria.

The sawmill of the Seymour Lumber Co., Vancouver, B. C., was destroyed by fire, May 14. Loss, $75,000.

The plant of the Diamond Glass Co., Hamilton, Ont., was destroyed by fire, May 18. Loss, $25,000.

The sawmill of the Carney Lumber Co., Owen Sound, Ont., was completely destroyed by fire. Loss, $150,000. The mills were owned by Fred and Frank Carney, Marinette, Wis.

The Interlake Tissue Mills, St. Catherines, Ont., has awarded the contract for the construction of its two-story factory, 100x208 ft.

The Cerveceria de Monterey Co., Botica San Luis Building, Monterey, Mex., will soon erect a large brewery plant, at Monterey. A cold-storage plant will be built in connection. Dr. Ramon Trevino and John Forseck are interested.

NEW INCORPORATIONS

GENERAL MANUFACTURING

The following companies have been incorporated to manufacture:

The American Life Saving Garment Co., Boston, Mass.; life-saving apparel. Capital, $25,000. Incorporators: John B. McSwain and John R. Batchelder.

The Fairmont Creamery Co. of New York, Buffalo, N. Y.; dairy products. Capital, $50,000. Incorporators: Lamont Brace, Buffalo, and George W. Summer and Joseph H. Rushton, Omaha, N. Y.

The Novelty Games Co., Boro. Manhattan, N. Y.; games and novelties. Capital, $10,000. Incorporators: Francis H. Medhurst, Joseph H. Tucker and Eleanor Medhurst, 114 East 18th St., New York, N. Y.

The Un-X-L-D Paper Box Co., Boro. Manhattan, N. Y.; paper boxes. Capital, $10,000. Incorporators: Samuel L. Green, 822 Beck St., Harry M. Levy, 107 Clinton St., and Samuel J. Joseph, 837 Beck St., New York, N. Y.

The W. & G. Film Co., Boro. Manhattan, N. Y.; motion-picture film. Capital, $10,000. Incorporators: Arthur B. Graham, 310 West 97th St., Howard E. Brown, Summit Ave. and 161st St., and Robert M. Simpson, 474 Central Park West, all of New York, N. Y.

The Lenox Silk Works, Boro. Manhattan, N. Y.; silk and wool textiles. Capital, $10,000. Incorporators: Harry B. Hull and Anna B. Hull, 170th St. and Fort Washington Ave., New York, N. Y., and Walter B. Griffen, Mahwah, N. J.

The Greenfield Shoe Co., Boro. Manhattan, N. Y.; shoes. Capital, $3500. Incorporators: Regina Greenfield and Phil Greenfield, 779 8th Ave., New York, N. Y., and David Schwartz, 527 Broadway, Brooklyn, N. Y.

The Onyx Mills Co., Manhattan, N. Y.; woolen and worsted goods. Capital, $10,000. Incorporators: Maurice Goldman, 849 Glenmore Ave., Brooklyn, N. Y.; Nathan Cohen, 1642 Madison Ave., and Joseph Abramson, 23 West 111th St., New York, N. Y.

The McCahill Soda Fountain Co., Boro. Manhattan, N. Y.; soda fountains. Capital, $50,000. Incorporators: William J. McCahill and Charles F. McCahill, 319 East 53rd St., and Theodore B. Hoy, 150 Nassau St., all of New York, N. Y.

The Fancy & Plain Paper Box Co., Boro. Manhattan, N. Y.; paper boxes. Capital, $5000. Incorporators: Tanchem Bandolik, 433 Wyonne St., Brooklyn, N. Y.; Costas G. Papaconstantinou, 65 Forsyth St., and E. A. Eichner, 6 Park Row, New York, N. Y.

The Virginia Stave Co., Manhattan, N. Y.; lumber. Capital, $25,000. Incorporators, E. G. Chamberlin, W. E. Mitchell, Montclair, N. J., and H. D. Nims, Bronxville, N. Y.

The Malkan Furniture Co., Manhattan, N. Y.; furniture. Capital, $5000. Incorporators, Charles Malkan, 216 West One Hundred and Forty-third St., and Joseph Malkan and Jacob Malkan, 607 Ninth Ave., New York, N. Y.

The Empire Furniture Co., Manhattan, N. Y.; furniture. Capital, $6000. Incorporators, Jacob Harrison and Fanny Harrison, 34 Cedar St., and Isidore Meislich, 387 South Fourth St., Brooklyn.

The Erstling Bros. Knitting Mills, Manhattan, N. Y.; knit goods. Capital, $10,000. Incorporators, Louis Rothschild, 4 East Sixtieth St.; Max Erstling, 549 West One Hundred and Forty-fifth St., and Joseph R. Erstling, 318 West One Hundred and Thirteenth St., all of New York, N. Y.

The East Windsor Hill Brick Co., New Windsor, N. Y.; bricks. Capital, $36,000. Incorporators: Joseph A. Lahey, Hartford, Conn.; Annie A. Lahey, Newburg, N. Y., and Nora M. O'Meara, Kingston, N. Y.

The Niagara Falls Linen Co., Niagara Falls, N. Y.; textiles. Capital, $150,000. Incorporators: George R. Shepard, 609 Jefferson Ave., Adin B. Chase, 531 6th St., and Alan H. G. Hardwiche, 269 3rd St., Niagara Falls, N. Y.

The Rochester Asbestos Shingle & Fire Proofing Co., Rochester, N. Y.; asbestos shingles and building supplies. Capital, $150,000. Incorporators: C. H. Briggs, Granite Bldg., William H. Karnes, Granite Bldg., and W. G. Gilbert, Eggleston Hotel, all of Rochester, N. Y.

The Genesee Textile Co., Rochester, N. Y.; textiles. Capital, $35,000. Incorporators, J. Sawyer Fitch, Hugh Satterlee and H. D. Van Duser, Rochester, N. Y.

The Ocean Pearl Button Works, 213 26th St., Guttenberg, N. J.; pearl buttons and products. Capital, $2100. Incorporators: F. Jelinek, Thomas Uranek and William Prochaska.

The Lobsitz Mills, Harrison St., Nutley, N. J.; silk and other textile fabrics. Capital, $250,000. Incorporators: William F. Pippey, George W. Levett and H. L. Basch, all of New York, N. Y.

Stark & Faussett, 227 East State St., Trenton, N. J.; mantles, tile and tile works. Capital, $50,000. Incorporators: Charles W. Stark, George U. Noorhead and W. F. Smith.

The King Cotton Mills Co., Richmond, Va.; cotton goods. Capital, $100,000. Incorporators, H. D. Eichelberger and W. B. West.

The Barnesville Knitting Co., Barnesville, Ohio. Capital, $10,000. Incorporators: John B. Conard, Florence Conard and Inex L. Wise.

The Parker Embroidering & Braiding Co., Chicago, Ill.; braids and trimmings. Capital, $7500. Incorporators: Bazil Maxant, Leo A. Schueneman and Frank Maxant, all of Chicago.

The Adascope Co., Chicago, Ill.; stereopticon and advertising devices. Capital, $2500. Incorporators: Rudolph Muller, James P. Coughlin and J. E. Hurtubise.

Trade Catalogs

Skinner Chuck Co., New Britain, Conn. Catalog. Chucks. Illustrated, 52 pages, 4x7¼ in.

Armstrong Bros. Tool Co., Chicago, Ill. Booklet. Tool holders. Illustrated, 48 pages, 6¼x3¾ in.

Rockford Drilling Machine Co., Rockford, Ill. Catalog. Gang drills. Illustrated, 31 pages, 9x6 in.

National Acme Mfg. Co., Cleveland, Ohio. Catalog. Parts for the trade. Illustrated, 30 pages, 5x7 in.

Makutchan Roller Bearing Co., McCormick Bldg., Chicago, Ill. Catalog. Roller-bearing hangers. Illustrated, 31 pages, 6x9½ in.

Forthcoming Meetings

American Society of Mechanical Engineers. Spring meeting, May 28-June 1, Hotel Hollenden, Cleveland, Ohio. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Master Car Builders' Association. Annual convention, Atlantic City, N. J., June 12-14. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

American Railway Master Mechanics' Association. Annual convention, Atlantic City, N. J., June 17-19. Jos. W. Taylor, secretary, 390 Old Colony Building, Chicago, Ill.

Society for the Promotion of Engineering Education. Annual meeting, June 26-28, Boston, Mass. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

Society of Automobile Engineers, summer meeting, June 27-29, Hotel Ponchartrain, Detroit, Mich. C. F. Clarkson, secretary, 1451 Broadway, New York City.

American Railway Tool Foreman's Association. Annual convention, July 9, 1912, Chicago, Ill. H. L. Mills, secretary, 835 Monadnock Building, Chicago, Ill.

American Foundrymen's Association. Annual convention, Buffalo, N. Y., Hotel Statler, Sept. 24, 25, 26. Richard Moldenke, secretary, Watchung, N. J.

The Institute of Operating Engineers. Regular meeting second Thursday of each month, Engineering Societies Building, New York City. H. E. Collins, secretary, 29 West Thirty-ninth St., New York City.

American Society of Mechanical Engineers. Monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth St., New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's Hotel. D. F. S. Clark, secretary, 141 Milk St., Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. J. A. Brooks, secretary, Brown University, Providence, R. I.

New England Foundrymen's Association. Regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania. Monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton Building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland. Monthly meeting third Saturday. Philip Frankel, secretary, 310 New England Building, Cleveland, Ohio.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1785 Monadnock Block, Chicago, Ill.

Philadelphia Foundrymen's Association. Meetings first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

American Society of Engineer Draftsmen. Regular meeting third Thursday of each month. Walter M. Smyth, secretary, 116 Nassau St., New York City.

WANTS

25 cents per line for each insertion under "Men and Positions Wanted," 50 cents per line under "Miscellaneous." No advertisements abbreviated. Copy should reach us not later than Friday noon for ensuing week's issue. Answers addressed to our care, 505 Pearl St., New York, will be forwarded. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for positions.

Men Wanted

Connecticut

SALESMAN to sell well known good high speed steel in Connecticut; able, energetic man with good standing and Connecticut acquaintance only need reply; correspondence confidential. Box 330, Am. Machinist.

ENGINEER-SALESMEN—Manufacturer of well known high-grade automobile, about to place motor trucks on market, has opening for several engineer-salesmen competent to take charge of truck departments at its branches as business develops; experience in motor trucks not required, but selling ability and mechanical knowledge essential; exceptional opportunity for men of proper caliber; state experience, references, salary desired, age, married or single. Address "R. S.," Am. Machinist.

Illinois

DRAFTSMEN AND TRACERS — We are constantly in need of the services of first-class draftsmen and tracers; some men are required on tool work and it is possible to place some on detailed and assembled drawings of agricultural implements. Applications requested addressed David Bradley Manufacturing Works, Bradley, Ill.

Indiana

SUPERINTENDENT, a high grade, or foreman for tool room in modern factory; must be competent teacher of men and thoroughly conversant with improved shop methods; give experience and references. Box 337, Am. Machinist.

SUPERINTENDENT for a department of our works devoted to the manufacture of very accurate small cast iron and steel gears; must be a high grade, high minded mechanic who is naturally qualified to train and hold his workmen and who is well informed on modern tools and shop practices; information as to experience, references and qualifications for such position will be treated confidentially; a good opportunity for the right man. Box 336, Am. Machinist.

Iowa

FOREMAN — Experienced automatic machine foreman, capable of tooling Brown & Sharpe, National-Acme, Cleveland and Potter & Johnston machines and producing accurate work at the least cost; permanent position; state experience and wages expected. Address "Automatic," Am. Machinist.

Kansas

MACHINIST, expert; give references and experience upon different machines and with gasoline engines. Box 329, Am. Machinist.

Maryland

DRAFTSMAN, experienced in high-speed stationary engines. Box 227, Am. Machinist.

Massachusetts

DIE SINKER, first-class, experienced on small follow-up dies; 40c. to 50c. per hour, according to ability; steady work; Boston. Box 355, Am. Machinist.

Michigan

ASSISTANT PURCHASING AGENT; must have good experience, good address, be a close buyer and competent to handle good big proposition; prefer a young man who is looking for advancement as result of conscientious work. Box 371, Am. Machinist.

Missouri

FOREMAN with good mechanical and executive ability, to take charge of a special department using various kinds of power emery grinding machinery; man with frog and switch shop experience preferred. Curtis & Co. Mfg. Co., St. Louis, Mo.

FOREMAN for machine grinding department of manganese steel foundry, making railroad track work; must have mechanical and executive ability, also frog and switch shop experience; write with references, or apply in person. St. Louis Steel Foundry Co., St. Louis, Mo.

STENOGRAPHER for St. Louis, 20 to 25 years old; one mechanically inclined, who can develop into a correspondent; he must have good approach, initiative and capacity; give references; state age, experience, present and last employer; must be neat in appearance; salary to start, $75 per month; good opportunity for advancement. Box 364, Am. Mach.

New Jersey

OPERATORS, two, experienced on Potter & Johnston turret lathes. Apply Crocker-Wheeler Co., Ampere, N. J.

ENGINE MAN, first class, all-round, who is thoroughly familiar with repairs, also capable of doing machine and erection work. Apply at once at the Crossley Machine Co., State and Monmouth Sts., Trenton, N. J.

New York

DRAFTSMAN, experienced on jigs, gages and special tools; good position for skilled man. Box 357, Am. Machinist.

MAN with foundry and pattern-making experience for executive position with large machine-building concern. Box 358, Am. Machinist.

FOREMAN—Experienced, all-round, to take the position as foreman of grinding department in factory in New York State; age, 25 to 35 years; give reference and state salary expected. Box 370, Am. Machinist.

OPERATOR—An experienced B. & S. automatic screw-machine operator, preferably also familiar with the Hartford automatics. Box 366, Am. Machinist.

FOREMAN, young or middle aged, for small jobbing and repair shop working about 20 men; a live wire with some idea of shop management who can get along with men; state experience; good future. Box 363, Am. Machinist.

OPERATORS—Automatic screw machine operators on Brown & Sharpe and Acme machines; state experience and wages expected; references required. Address Camera Works, Eastman Kodak Co., Rochester, N. Y.

DESIGNER, experienced on woodworking machinery for a large shop in New York state; must be familiar with shop practice and operation of machines; give references and salary expected. Box 331, Am. Machinist.

TOOL MAKERS, few first class, on small accurate work; good wages and steady employment; also two screw machine hands; only competent men need apply. Bundy Mfg. Co., Endicott, N. Y.

ASSOCIATE EDITOR for a technical journal in the machine-building field; a technical education or its equivalent; thorough experience in machine design and machine shop practice, and demonstrated ability to write are essentials. Box 300, Am. Machinist.

Ohio

SALESMAN — Mechanical engineering graduate who is able to take care of gas engine and engineering correspondence and qualified for salesman. Box 354, Am. Machinist.

SALESMAN in the New England territory for a special line of machine tools; young man with thorough shop training required. Address, stating age, experience, etc. Box 328, Am. Machinist.

BY A LARGE CONCERN in Ohio, a capable man to take charge of tool making and designing; experienced on cutting tools for monitors and screw machines; give age, experience, references and salary expected. Box 362, Am. Mach.

A MAN of good mechanical ability and initiative to locate and remedy troubles, follow new work and perfect process in several departments dealing with power presses, furnace ovens, and general machine tools; give age, experience, references and salary expected. Box 361, Am. Machinist.

FIRST-CLASS machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

ASSISTANT SUPERINTENDENT — A successful company, having one of the most modern plants in the country, employing over 500 men on high grade machinery, wishes to engage a man about 35 years of age to become associated with it as assistant superintendent to start with, and if satisfactory results are shown to later become superintendent or works manager; applicant must be a high grade man, both as to character and ability, of good presence and with both technical and shop training; company has designing engineers, but applicant must have good judgment as to mechanical design; in plain words, a man is wanted who can in time take the responsibility of shop production of the company, and if desired, an opportunity will be given, in due course, to become financially interested in it; preference will be given a man who has had some experience in the manufacture of machine tools; in making application give full information as to experience, etc.; application will be treated as strictly confidential. Box 334, Am. Machinist.

Pennsylvania

OPERATORS, first-class, on Gisholt turret lathes and Gridley automatics; in writing state age, experience and pay desired. Box 365, Am. Machinist.

DRAFTSMEN, several; applications solicited from men with either ordnance, mechanical-electrical, or mechanical-structural experience; state fully age, experience, education and salary expected. Box 319, Am. Machinist.

OPERATORS—The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

Wisconsin

MANUFACTURING concern desires a man with some experience to take charge of chemical and physical laboratory, steel work chiefly, including analysis and heat treatments. Address, stating experience and salary, Box M. L., Am. Mach.

FOREMAN required for transmission and axle assembly departments in automobile part manufacture; applicant must have successfully handled such departments on progressive methods; state full particulars and salary expected. Box 314, Am. Machinist.

ANALYTICAL CHEMIST and metallurgist, by a large manufacturer; we are looking for a man who has thorough knowledge of steels and who has sufficient experience to enable him to supervise work of hardening, tempering, etc.; here is a good opportunity for a first class man; give all particulars. Address "Automobile," Am. Machinist.

POSITIONS WANTED

Connecticut

FOREMAN pattern maker wishes to make change; man of exceptional ability familiar with wood, metal and molding machine; good organizer and productive agent. Box 372, Am. Machinist.

Illinois

SUPERINTENDENT—A married man, 33 years old, with extensive experience as foreman machinist, tool maker and draftsman, also assistant superintendent, at present employed as chief draftsman by one of the largest manufacturers of plumbing goods in the Central West, wishes a position as superintendent with a growing concern; am perfectly familiar with and can get results in all metal working departments. Box 383, Am. Machinist.

Indiana

HEAT TREATMENT OF STEELS—A practical man specialized in the above, open for engagement; best reference. Box 374, Am. Machinist.

Massachusetts

DESIGNER—Practical mechanic, with broad experience, designer of automatic machinery and modern tools, desires responsible position. Box 342, Am. Mach.

SUPERINTENDENT — Assistant or general foreman; technical graduate, 17 years' practical experience, 13 years as foreman. Box 341, Am. Machinist.

SUPERINTENDENT or general foreman desires change; practical mechanic, draftsman, and estimator, with considerable selling experience; capable of assuming full charge of shop manufacturing machinery or sheet-metal pressed goods. Box 369, Am. Machinist.

CHIEF DRAFTSMAN or assistant superintendent — Mechanical engineer, technical graduate, 12 years' practical shop, office and designing experience; shoe, special automatic, paper-handling machinery, rotary and flat-bed printing presses; change desired; references A1. Box 373, Am. Machinist.

Michigan

MASTER MECHANIC—Successful, experienced, technical and practical, with 12 years' experience, wants change after June 1. Box 359, Am. Machinist.

AUTOMOBILE DESIGNER, with originality, integrity and initiative, desires position with progressive company; capable executive and a hustler; member S. A. E. Box 375, Am. Machinist.

FACTORY MANAGER—I served four years' apprenticeship, three years tool making, eight years general foreman, two years assistant superintendent, five years general superintendent, three years chief engineer; age, 41; I am with one of the largest firms in this country and understand manufacturing; will consider a position as factory manager or general superintendent. Address "Confidential," Box 41, Am. Machinist.

New Jersey

FOREMAN, age 30, technical education, 10 years in shop and drafting room, expert on automatic screw-machine work, also up to date on jigs, fixtures and special machinery, desires responsible position either as foreman or assistant superintendent. Box 353, Am. Mach.

New York

DRAFTSMAN on jigs and fixtures, etc., desires permanent position. Box 377, Am. Machinist.

MASTER MECHANIC, age 37, best of references, wishes to make change; accustomed to large propositions. Box 378, Am. Machinist.

EFFICIENCY ENGINEER, cost expert, in ability and successful experience second to none, open for engagement. Box 379, Am. Machinist.

INSTRUMENT MAKER, foreman, with long experience on all kinds of scientific instruments, wishes a change of location. Box 381, Am. Machinist.

SHOP SUPERINTENDENT or assistant to manager; technical graduate, experienced in shop management, production and cost; good record. Box 360, Am. Machinist.

COST ACCOUNTANT desires change; thoroughly capable of handling entire cost department; young, energetic and reliable; best of references. Box 368, Am. Machinist.

TOOL DESIGNER or assistant superintendent; first class tool maker, technical education, well informed on modern tools and shop practices, age 28, wants position with live concern. Box 380, Am. Machinist.

TOOL-DIE MAKER, 33 years old, technical education, 17 years' experience, wishes to elevate his position; experienced on die sinking, cutting, drawing, dies, and expert on die castings; also draftsman and experimental work; able to take charge; A-1 references. Box 376, Am. Machinist.

MECHANICAL ENGINEER, age 39, married; high-class executive; seven years with present employers; now and for past four years head of mechanical department of large heavy metal products plant; will make change for prospects of bigger future. Box 349, Am. Machinist.

Ohio

GENERAL FOREMAN or superintendent of a manufacturing plant; 15 years' experience; location anywhere. "J. A.," Am. Machinist.

Pennsylvania

FOREMAN pattern maker wants position. Box 382, Am. Machinist.

SUPERINTENDENT, now holding this position in a large plant, high-grade work, wants a change; thorough mechanic; good executive ability. Box 346, Am. Machinist.

Wisconsin

FOREMAN, machine shop or tool room; age, 26; ten years' experience; A1 mechanic and producer; progressive and able to get results; employed; successful record and best references. Box 356, Am. Machinist.

SALES ENGINEER with wide experience on high-grade automatic machinery desires position where combined experience as machinist, designer, superintendent and successful salesman would count; would make investment with right concern. Box 367, Am. Machinist.

MISCELLANEOUS

Punch press tools, jigs, fixtures, etc. Taylor-Shantz Co., Rochester, N. Y.

Patents secured. C. L. Parker, patent attorney, 990 G St., Washington, D. C.

Work for screw machines and gear cutter wanted. Box 775, Am. Machinist.

Work for 2x24 Jones & Lamson lathes and work for automatic gear cutters wanted. Box 267, Am. Machinist.

Machine to twist 1" to 2"x$\frac{1}{4}$"x6 ft. steel wanted; every twist must be same distance apart. Send catalog and prices to the Leetonia Tool Co., Leetonia, Ohio.

For Sale — Machinists, tool makers, draftsmen: We have a few tool cases to sell at a sacrifice; write us at once. The Ohio-National Mfg. Co., Chillicothe, Ohio.

We manufacture machinery, but want to take on something in addition to increase our yearly business. What have you to offer? Box "A. X.," Am. Mach.

For Sale—One 8"x24" Allis-Chalmers Corliss engine; one four-spindle Turner cock grinder; first-class condition. For prices apply to J. E. Lonergan Co., 211 Race St., Philadelphia, Penn.

Experimental apparatus or anything needing extra good machine shop work and oversight can be economically built at my new laboratory and shop. A. H. Emery, Stamford, Conn. Works at Glenbrook, Conn.

Machine shop wanted in the vicinity of New York City, with equipment adapted for the manufacture of small and medium size electric machines and devices; in replying, give full particulars, location, rent, price, etc. Address Box 3-E, care Doremus & Co., 44 Broad St., New York.

For Sale—Two 10x17x12" tandem compound center-crank Ames engines, now running on 125 lb. steam pressure, 270 r.p.m., direct-connected to 75-kw., compound-wound, 500-volt, direct-current General Electric generators; one 12"x12" plain center-crank Ames engine, now running on 125 lb. steam pressure, 300 r.p.m.; all in good running order and being sold to make room for larger installation. May be seen at power plant of Farrel Foundry & Machine Co., Ansonia, Conn.

Talks With Our Readers

By The Sales Manager

Cleveland Automatic Machine Company

A. L. Garford, *Pres't*
J. P. Brophy, *V. Pres't & Gen'l Mgr.*
G. F. Climo, *Sec'y & Treas.*

Manufacturer of the

"Cleveland"

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Automatic Chucking, Screw and Forming Machines

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Vienna
London
Manchester
Birmingham
New Castle-on-Tyne
Glasgow
Yokohama

Cleveland 5-9-12

Mr. Mason Britton, Mgr.
American Machinist
New York City

Dear Mr. Britton:—

I have read with much pleasure your interesting favor of the 6th; also the enclosed printed matter has been gone over by me carefully and I appreciate very much all you have to say.

As far as I am concerned, I am sure that I would not care to act as judge in a case of this kind. Undoubtedly your particular business has been studied closely in all directions and the conclusion you have reached is, without question, the correct one.

You know, Mr. Britton, it is every man to his own business, and when the Hill Publishing Company reaches the conclusion that they are going to do this, that or the other thing and figure that it is the best thing to be done for themselves as well as the parties who advertise in their valuable paper, there is hardly a chance that they are making any mistake. The whole matter reads good and I am quite satisfied that you are on the right track.

For up-to-dateness you fellows stand, I might say, alone. Progressiveness in the extreme is what governs the Hill Publishing Company; of that I am quite satisfied. The fact is, I always have been under this impression, very strongly. Anyone that has been dealing with your company as long as we have and gotten along as nicely in every way, realizes quite well that you are bound to have the best you possibly can in the way of an advertising medium, and this is the way I have figured you out for many years

If I did not think this way strongly, the chances are I would most likely say so even tho it might be injurious to me. I have a strong characteristic of speaking plainly to most anyone on most any subject, and when I speak so highly of your paper, using the best language I can to impress upon you that I believe the Hill Publishing Company to be a genuine Leader, you may rest assured that I feel that way.

The fact is, if I were to sit here for a year trying to dictate to you my feeling in reference to the American Machinist, I could not say too much in favor of your paper. I hope you will realize, after reading this communication, that every word I have uttered is just as I feel in the case. Why I am so emphatic on the subject is simply because of my appreciation of the wonderful work you people have done in building up a paper which is known from one end of the World to the other and is classed as a second to none proposition for those wishing to place before the interested readers that which they manufacture.

With very kindest regards, I remain,

Yours truly,

J. P. Brophy

JPB SB

* * *

Only reliable products can be continuously advertised.